The Australasian Wireless Review

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ILLUSTRATIONS

The "Australasian Wireless Review" is forwarded to any address in Australasia for **16s.** per annum.

High Potential Without a Transformer

ONE of the first problems to confront the experimenter who desires to try transmitting is that of providing the necessary high potential d.c. for the plate of the transmitting valve. If the line supply is a.c. (alternating current), a rectifier of some kind and a transformer are requisitioned. If the supply current is d.c. (direct current), a rotary converter will step up the voltage to the potential required.

If the line current is 110 a.c., a method of raising the voltage is set out in the accompanying diagram. By this plan the 110 volts current a.c. is raised to 275 volts d.c., and, of course, if the line current is 240 volts a.c. a proportionate rise in the voltage will be obtained.

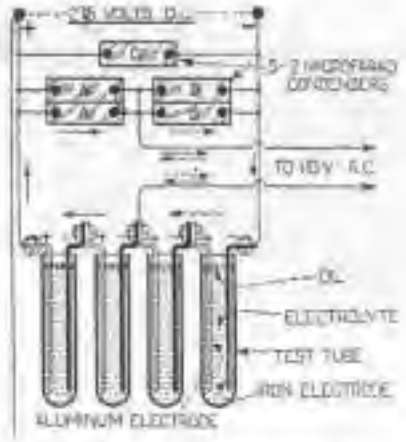
Five two-microfarad paper condensers are required and an electrolytic rectifier, made up of four test tubes, 6 inches long by one inch diameter. The positive electrodes consist of half-inch wide strips of aluminium, and the negatives may be either tin, iron, or lead.

Ordinary stove pipe iron gives excellent results.

The electrolyte is a saturated solution of borax or baking soda, and ordinary tap water will serve. A saturated solution of any chemical is made by dissolving as much of the chemical in the water as is possible.

The rectifier tubes and condensers can be made up in a neat unit in a wooden box, painted inside with what is known as P.H. paint, the bituminous paint used in putting on Malthoid roofing. If this paint is too thick it may be thinned down by the solvent, carbon-bi-sulphide, an evil-smelling liquid, which is very inflammable, and must therefore be kept away from flame whilst being applied.

The action of the unit is explained as follows:—Assume the first half of the cycle of the alternating current wave takes the path shown by the full line arrows. This will charge the condensers "A" to the maximum value of the alternating current voltage, which is 110 x $\sqrt{2}$, or 154. The next half cycle will take the path shown by the dotted arrows. This will charge the condensers "B" to 154 volts. Since condensers "A" are connected in series with condensers "B," the voltage across both condensers will be 2 x 154, or 308. But there is a voltage drop across the rectifier tubes due to the resistance of the electrolyte, and also a current leakage through them, so that the output voltage will be reduced to about 275. The function of the condenser "C" is to help filter or smooth out the resulting pulsations, and hold the voltage constant. In this, as in all experiments with supply line currents, the precaution should be taken of having a three-inch length of low capacity fuse wire on each lead from the supply lines. The easiest way to put in the fuses is to have a pair on terminals about 21 inches apart to receive the supply lines, and a second pair of terminals three inches distant from the first pair to connect to the rectifiers and condensers, with a three-inch length of the fuse wire between both pairs of terminals. The necessary terminals may be mounted on the box holding the rectifiers and condensers.



Plan of the Rectifier-Condenser Unit

To prepare the waxed paper for condensers, a cheap white paper, such as is used in the commoner kinds of writing pads, will do.

This is dried in an oven at a low temperature. The paraffin wax is melted in an enamelled dish placed on the top of a pan of boiling water. One end of the warmed paper is pushed under the wax, and the whole of the sheet slowly drawn through. Holding the sheet by two corners, the superfluous wax is allowed to drain off, and the waxed sheet is then thrown over a string line to set, or clipped on to the line by paper clips.

By the formula:—

$$C = \frac{k \times A}{4 \times 3.1416 \times 10^5 \times 9 \times t}$$

where C—Capacity in microfarads

k—Dielectric constant (paraffin wax paper—1.9)

A—The effective area of the tinfoil in square centimetres.

t—Distance of separation by the wax sheets, i.e., dielectric thickness of the waxed sheets in centimetres.

(The effective area of the tinfoil is the area actually between the waxed sheets.)

The number of waxed sheets and the area of tinfoil required to make the condensers may be ascertained.

If the house supply current is 240 volts a.c., which, on the foregoing plan, would be brought up to over 600 d.c., and which might be too high for the experimenter's purpose, a 110, 120, or a 130 volt lamp of low candle power placed in series with one of the supply lines would deliver to the rectifier-condenser unit 130, 120, or 110 volts respectively, with a corresponding decrease in the d.c. voltage delivered.

Michael Idvorsky Pupin

Ph. D., Hon. D. Sc., Ll. D., PROFESSOR OF COLUMBIA UNIVERSITY

PROFESSOR MICHAEL IDVORSKY PUPIN was born at Idvor, Banat, Hungary, on October 4th, 1858. From a very early age he was an ardent student, and took full advantage of the splendid educational facilities available in his own country. After he had reached man's estate, he made his way to London (England), and entered the John Hopkins University, where, in 1888, he gained his LL.D. A year later the degree of Ph.D. was conferred upon him at the Berlin University. In the same year (1889) he journeyed to the United States, and became assistant teacher in electrical engineering at the Columbia University, New York. From 1890 until 1892, he was instructor of mathematics and physics at the same institution, and, in the latter year, was appointed Professor of Mechanics, a position which he occupied until 1901, when he was elevated to his present position, that of Professor of Electro-mechanics.

Professor Pupin is a member of the American Academy of Sciences; Member of the American Philosophical Society; Member of the American Physical Society; Member of the American Mathematical Society; and is a member of the Institute of Electrical Engineers.

He gained the degree of D.Sc. at the Columbia University, in 1904.

In addition to being a member of the leading scientific institutions of America, Professor Pupin is also a Member of the French Academy of Sciences, and is a Member of the Serbian Academy of Science.

He is universally recognised as one of the world's leading scientists, and as an authority of a high order in matters electrical.

Notwithstanding his busy life at the Columbia University, his great capacity and energy permit him to contribute to a number of scientific magazines, and he has written a comprehensive work, entitled, "South Slav Monuments," a book dealing with the wonderful architecture of the Serbian Churches.

He has devoted his attention to wireless matters for many years, and, during the war, he presented the United States Government with an invention for the elimination of interference by static, the precise nature of which has not been made public.

It is worth noting that although the celebrated regenerative circuit is universally spoken of as the "Armstrong Regenerative Circuit," the name of Professor Pupin is coupled with that of Major Armstrong, in the application for the patent, and both are described therein as the applicants and actual inventors.

It is hard to say what part was actually played in the invention of the regenerative circuit by Professor Pupin, but it is certain that Major Armstrong had the benefit of the Professor's mature experience in wireless research matters, to aid and guide him.

Transmission Tests by Melbourne Amateurs

DURING the last few weeks Messrs. Hull, Holst, and Love, whose call signs are 3.J.U., 3.B.Y., and 3.B.M. respectively, have installed low power 'phone transmitters, the input maximum being 6 watts.

In the initial tests all three stations proved to be very efficient over a distance of five or six miles, with a signal strength equal to that of stations employing ½ k.w. of power.

Desirous of testing the powers of their equipment over longer distances, advantage was taken of the opportunity afforded by Mr. H. W. Maddick, Honorary Secretary of the Wireless Institute of Australia, Victorian Division, leaving Melbourne for Echuca on vacation. Hurried arrangements were made, and the necessary apparatus packed for a complete test of the capabilities of the very low power transmitters.

Arrived at Echuca, Mr. Maddick set up a single wire aerial between two trees, about 25 feet from the ground.

The receiver was simply a portable affair, employing a single valve.

The first station to be heard was 3.J.U., whose C.W. was copied without a break, and after notification by telegram of the success of the reception, several long messages were transmitted by the same station, and were received with the same success.

A few days later the songs of Mr. Ferguson, a well-known Melbourne vocalist (who was assisting in some modulation tests being carried out at 3.J.U.), were clearly received in Echuca, as was the voice of Mr. H. Holst, transmitted from 3.B.Y.

Tests were conducted night after night, and notwithstanding that atmospherics were by no means absent, the transmitted speech of 3.J.U., 3.B.Y., and 3.B.M. could be clearly heard all the time.

Testing in broad daylight revealed the fact that the voices from the foregoing stations were still clearly audible.

The transmitter at 3.B.U. consists of a B.T.H. 5 watt valve supplied with 400 volts d.c., obtained from a transformer operated from the lighting circuit. The high voltage from the transformer is rectified by an electrolytic rectifier, and is smoothed out with the usual chokes and condensers. The filament of the valve is also supplied from the a.c. circuit through a step-down transformer, having the usual centre tap.

The aerial is a twin wire inverted "L" 80 feet long and 40 feet high, used in conjunction with a three wire, fan shaped counterpoise.

3.B.Y. and 3.B.M. are similarly equipped, with the exception that, in both cases, umbrella type aerials are used, the heights being 80 feet and 70 feet.

Grid modulation is used in all three stations, and has proved exceedingly effective, the quality of the speech, in all cases, being practically faultless.

From the results of these tests it will be seen that Melbourne experimenters are not very backward in the matter of the transmission of radio telephony, although their practical experience in transmission only extends over a period of a few weeks.

The amateurs of the rest of Australasia may look to their laurels, as Melbourne experimenters are going to have a hard try to break Australian transmission records, even under the handicap of attempting long distance work on low power with a short wave length.

The latest report from 3.J.U. states that T.A.A., Mr. T. Watkins, Hobart, Tasmania, has advised that he heard the C.W. signals from 3.J.U. on several consecutive nights.

In the reception, only a single Armaka valve was used.

One long message was received from 3.J.U. when the plate input was only 2.7 watts.

Answers to Correspondents

W. E. Clements, Richmond.—Your postal card, re article "Made from a Lamp-holder, in the February Review," does not make quite clear exactly what you want. If you want the plug-in device, any of our advertisers will probably be able to supply you, as most of the dealers are stocking these plugs. If you have any difficulty in obtaining one, you can easily make up a substitute as full directions were given in the article you mention. You enquire about a "set" and if you mean that you want a receiving set to work off a power line aerial, kindly let us know and we will be pleased to advise you further.

W. R., Mosman.—The Crosley Condenser is not yet stocked in Australia, so far as we know, but any of the dealers would import it for you. The Bradley Rheostats are being sold by Miss Wallace, Royal Arcade. Regarding the filter circuit for the Armstrong Super Regenerative Set, we are endeavouring to get a Sydney electrician to make up graphite 12,000 ohm resistances and the .1 Henry choke. We will advise you as to results.

To W. H. Graham, Illawarra Radio Club: We are somewhat early this month on our make-up of the "Review," and will not be able to get your excellent report in in full. You will note that we have corrected the statement re the night your club meets. Will you be good enough to let us have reports by the 7th of the month at the latest?

Wallace Steven, Bowen Hills, Brisbane.—As the first competitor in the novelty photograph section, you take the prize of 10/6, which we have pleasure in forwarding. The photo is in this issue.

To C. McClure, North Sydney Radio Club: We regret that your article was too late for this issue. We will have pleasure in publishing it at the first opportunity.

Editorial

ABOUT THOSE PATENTS

OUR editorials in the February and March "Reviews" seem to have caused some perturbation in the minds of certain people, who have elected to proffer gratuitous advice to all and sundry who may dare to think that they have the right to manufacture and sell radio apparatus.

A certain company is alleged to have control of the situation, and if we were sufficiently gullible to believe that statement, it would necessarily follow that the hundreds of English and American manufacturers who, to-day, are turning out radio apparatus, must all be infringing the wonderful array of patents mentioned. Which is an absurdity!

The gratuitous advice referred to is to the effect that those contemplating the manufacture and sale of radio apparatus should seek advice from a patent attorney.

In the first place, if a patents attorney is to search through hundreds of patents, a fee running into a hundred or so of pounds would be charged. In the second place, what patent attorney is there in Sydney who has sufficient technical knowledge of the subject to give a reliable report on any of the very involved specifications pertaining to radio patents?

Our critic very carefully omits to state anything about the facts we quoted in our February issue, relating to the expiry of the Lodge Loading Coil Patent and the Marconi Four Circuit Tuning Patent. It is a fact that these patents have expired, and that they may now be freely used by all and sundry.

The use of the loading coil is too well known to require any comment, but what is embodied in the Marconi Four Circuit Tuning Patent, now expired, is not so clear, so we will repeat the wording of the patent specifications as quoted by us in the February "Review." They are as follow:—

"The transmitter has the antenna system coupled to the oscillatory energising circuit, and each of the circuits tuned to resonance. At the receiver, the antenna system is coupled to the receiving set, and the circuits tuned to resonance with the circuits at the distant transmitter."

That effectually settles the question relating to tuning circuits, either in receivers or transmitters.

We are not at all impressed by the volume of words with which our critic has endeavoured to cloud the issue, nor by the vague references to certain patents.

Our patent laws do not allow people to make a mystery of patents which they may hold—it specifically requires them to make open declaration of the patents covering any given piece of apparatus or machinery.

The law requires that the number of the patent and its date shall be given when any claim of infringement is made.

A radio receiver is a relatively simple thing. It consists of the circuit, tuning coils, condensers, and the valve or valves.

In connection with a receiver, we ask for a definite statement as to patents held, with their number and date, regarding the following component parts of a receiver:—

1. The condensers, fixed or variable.
2. The valve or valves.
3. The tuning coils.
4. The circuit, if regenerative.
5. The circuit, if non-regenerative.
6. The grid leak.

In connection with a transmitter, we ask for a definite statement as to patents held, their number and date, regarding the following components:—

1. The condensers, fixed or variable.
2. The valve or valves.
3. The tuning coils.
4. The circuit.
5. The grid leak.
6. The filter circuit.
7. The system of modulation.

The most puerile statement made by our critic is when he states that he would not attempt to cover such a field as that of the patents held.

Does he ask us seriously to believe that he cannot make a definite statement as to the patents covering the simple components of a receiving or a transmitting set? Surely not.

Has he not all the necessary data at his command, or available, by walking a few paces and getting exact information from those who would institute actions for infringement, if such action could be taken?

We don't want clouds of words, we don't want mysteries, but we do want the specific statements required by the patents law as to date and number of patents which any person, firm, or company may claim to be infringed if certain radio apparatus is manufactured and sold in this country.

We throw open our columns to any person, firm, or company who may give us the definite particulars we have asked for in connection with radio receiving and transmitting sets. We ask for a plain statement of fact in each case, and we will publish, free of charge, the full particulars of the patents covering any of the component parts of receiving and transmitting sets as tabulated by us herein.

We will take care that this editorial reaches the proper quarter by registered post, and we invite anyone concerned to avail themselves of this opportunity to protect themselves in the matter of any patents they may hold.

Let us have facts, the numbers and dates of patents, in each case.

Let us now remind all intending manufacturers of radio apparatus that there is a clause in the Commonwealth Patents Act providing for the granting of compulsory licences to manufacture where a patentee has failed to bring to the public use and benefit any article patented by him. If it is necessary, this section of the Act may be taken advantage of in the case of any patent after it has been two years in operation.

Elementary Magnetism and Electricity

Article 2

IN Article 1 it was shown that magnets are made by treating hard steel with "loadstone" or "lodestone," a magnetic ore found in many parts of the world, that if a piece of hard steel is stroked from the centre with two bar magnets, the steel becomes a magnet, and that if a magnet is brought near to a piece of iron or steel, magnetism is "induced" therein; that another kind of magnet was made of a piece of soft iron or steel, having insulated wire wound round it, called an "electro-magnet," and that this piece of apparatus was only a magnet when a current of electricity was flowing through the wire.

Hard steel retains its magnetism.

Soft iron or steel loses its magnetism immediately the electric current is switched off.

It was also pointed out, in Article 1, that magnetism is largely confined to the surface of the steel, as if a magnet is placed in acid and the surface eaten away, the magnetism is found to have almost disappeared. This is an important fact to remember, as thin magnets or laminations, as they are called, are generally used in building up electric dynamos or motors.

It is equally important to remember that a magnet can "induce" magnetism in a piece of iron or steel placed close to it, as "induction" is one of the main factors in dealing with electrical currents of high frequency and high potential such as are used in wireless.

If we take a stout piece of wire and bend it so that it passes over and under a compass needle, and then connect the ends of the wire to the terminals of a battery, the compass needle will move from the North-South position, to another position, the angle of which to the first position will depend upon the strength of the current. If the wires connected to the battery terminals are reversed, the compass needle will swing the other way. This piece of apparatus is called a galvanometer, delicate forms of which are used in the detection and measurement of very feeble electrical currents.

If a wire carrying an electric current is wound into a spiral form, and an electrical current passed through it, it will exert a powerful magnetic field in the direction of its axis, that is, if the wire is coiled round a lead pencil, the magnetic field would be in the same direction as the pencil, and the point of the pencil would be the place where the North pole of the magnetic field would be when the current was flowing in one direction. If the current is reversed, the South

A 6-inch Electro Magnet

pole of the field will be at the point of the pencil. A wire coiled in this way is called a solenoid. If the end of a small piece of iron rod is placed just within the hollow centre of a solenoid and the electric current switched on, the iron will be drawn into the solenoid. If the current is reversed, it makes no difference, the iron will still be drawn in, as it is attracted by magnetism of either polarity, and because the soft iron does not possess permanent magnetism.

To construct an electro magnet for experimental purposes, a six inch French wire nail may be bent into the form of a "U," and if it is then heated in a fire to a good red heat, and then cooled slowly in the ashes, it will be all the more effective as a "core."

Over the ends of the core slip two wooden reels and wind them full of wire of any size. The wire of the two reels is connected together at the inner end, and the outer ends of the wires, that is, the ends near to the ends of the "U" core, are led to battery terminals, and a single dry cell will serve the purpose. When the current is switched on, the magnet will pick any iron or steel article of small size, say, an old Sparklet bulb, and will drop it when the current is switched off. The writer once made a toy electric crane for a sick child, with a small electro magnet, one dry cell and an old bell push switch. A cotton reel with a piece of stout wire served as a winch with a winding handle, some fishing line did duty as the hauling chain, the crane arm and uprights were of thin wood slip, and these were screwed to a base 3in. x 4in., which in turn was bolted to another base 5in. x 5in., to allow the crane to swing round. Sparklet bulbs were loaded into a "railway truck" made of a small cigar box, with sections sawn from a cotton reel as wheels. The winch was unwound to lower the crane chain or fishing line, the end of the chain being attached to the electro magnet. When the magnet touched one of the old sparklet bulbs on the "stack," the button was pressed and the winch wound up, bringing the bulb with it. The crane was then swung round until it was over the railway truck, the button was released and the load was dropped. Needless to say, this little toy brought many hours of amusement to the small invalid.

When electro magnets are subjected to alternating magnetising currents, a heating effect is produced in the iron core which is called hysteresis. Hysteresis is the resistance of the iron core to the change of polarity which occurs when the electrical current is reversed, and

this property has been made use of in certain types of wireless telegraphy receivers.

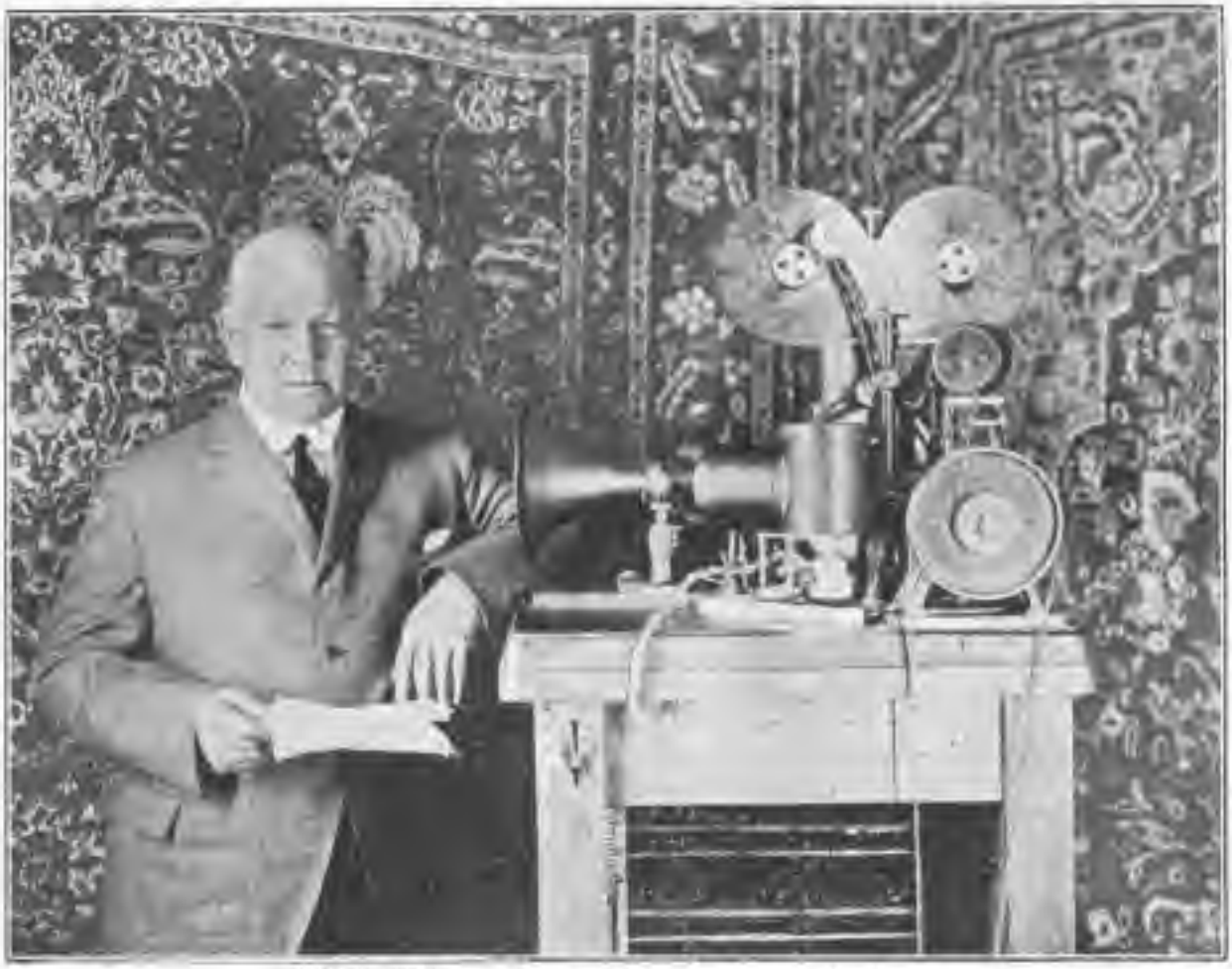
We have seen that a coil of wire (a solenoid), with a current passing through it, will attract and draw inside it a soft iron core.

If two solenoids are constructed, one small enough to slide inside the other, a galvanometer needle will be deflected as one solenoid enters the other, when the ends of one are attached to the galvanometer, and the ends of the other one to a battery. If the small solenoid is allowed to come to rest at the bottom of the larger one, the needle of the galvanometer will slowly return to its normal position. On withdrawing the small solenoid the galvanometer needle is again deflected, but this time in the opposition direction. In the first case, the small solenoid, the ends of which were attached to a battery, induced a current in the large solenoid. In the second case, a current was similarly induced, but in the opposite direction. It should be specially noted that the currents were only induced in the larger solenoid during the movement of the smaller one, and that there was no induction during a state of rest. If these simple facts are committed to memory, they will help the experimenter to understand the action of his loose-coupler or other inductance coil.

Induction takes place in wireless coils when they are at rest, it is true, but the current flowing in them is not the steady, direct current of a battery, but another kind of electric energy called alternating current, a current which flows in one direction at one instant, and in another direction the next instant. This time, it is the current that "moves," and, therefore, the coils may remain at rest.

Remember that there may be **movement without induction**, but that there **cannot be induction without movement.**

A Close View of the Marvellous Pallaphotophone



Wide World Photos, exclusive to the Australasian Wireless Review.

Secretary Daniels, of the United States Navy, speaking into the Pallaphotophone, a wonderful device described in the March number of the Review, which records the voice, music, or singing on a movie film. The film is developed and printed, and a series of zig-zag lines appear on an otherwise clear background. The film is then run through a broadcasting transmitting apparatus, and the voice, &c., are rendered as clearly as when the voice is transmitted direct. Secretary Daniels delivered a Christmas Greeting into the Pallaphotophone, and it was thus broadcasted on Christmas Eve to the United States Fleets, in port and on the seas, from Schenectady.

Radio Telephony

By "X"

IN this article I propose to explain some of the many points and problems met with in wireless telephony.

It is not my intention to be highly technical, but rather to explain to amateurs some of the points with which they may not have come into contact. First of all, it is desirable that the reader should have some knowledge of sound, and, therefore, I will first deal with the analysis of sound.

A definition of the word "sound" may be quoted as the sensation resulting from the action of an external stimulus on the nerve apparatus of the ear.

Production of sound is established by the vibration of a body called a "diaphragm." The effect of the vibration is to produce various physical effects in the atmosphere surrounding it, such as velocity displacements, accelerations and changes of temperature, density and pressure.

On account of the elasticity of the air, these phenomena occur periodically, and are transmitted from molecule to molecule in such a way that the effects are propagated in a radial direction from the sounding body. These disturbances of the atmosphere are called "sound waves," and travel at a velocity of 1132 feet per second in air at a temperature of 70 degrees Fahr.

Sound may be divided roughly into two classes, viz., "noises" and "tones." These being terms of contrast only according to whether they are pleasant to the ear or otherwise. Tones are sounds having such continuity and definiteness that they may be appreciated by the ear, thus rendering them useful for musical purposes. Their characteristics are pitch or frequency, tone colour, and intensity.

The pitch covered by the human voice in singing ranges from about 60 to 1300 cycles per second. The lower and upper limits of audibility are about 16 and 30,000 cycles respectively. Tone colour is the term applied to the characteristic tone of an instrument.

Ohm's Law of Acoustics states:—"All musical tones are periodic; the human ear perceives pendular (sine curve) vibrations alone as simple tones; all varieties of tone quality are due to particular combinations of a larger or smaller number of simple tones; every motion of the air which corresponds to a complex musical tone, or to a composite mass of musical tones, is capable of being analysed into a sum of simple pendular vibrations, and to each simple vibration corresponds a simple tone which the ear may hear." From this law it will be seen that nearly all sounds are composites of simple pendular vibrations.

Coming now to the matter of applying sound to electro-magnetic waves, as in wireless telephony, it is essential that the electro-magnetic wave produced to carry the sound waves be a pure sine wave, as all changes of amplitude in the carrying wave will be audible when receiving; it is, therefore, highly desirable that the only change of amplitude should be that effected by the sound waves. In wireless telephony a valve is generally used for the purpose of producing the electro-magnetic wave, as the wave emitted by the valve is practically a pure sine wave.

It follows that when using valves for receiving telephony, they should not be set oscillating, but just off the point of oscillation, when they will be producing that phenomenon known as "regenerative amplification," i.e., nullifying the resistance of the oscillatory circuits. If the receiving set is in a state of oscillation the "carrier wave" will be audible and will confuse the sound waves.

The change of amplitude effected by the sound waves, or "modulation," may be brought about in several ways. Amongst them are:—

1. Plate modulation.
2. Grid modulation.
3. Direct modulation.
4. Semi-direct modulation.

Plate modulation is the only method which has proved satisfactory, so far, for long distance transmission with high power.

The chief advantages of this system are the volume of power which may be modulated and the non-selectivity of adjustment.

The action of a plate modulation is as follows:—

The resistance drop across the modulator valve is varied by the application of sound through the microphone between the grid and filament, thus varying the difference of potential applied to the oscillation valve. Consequently the amplitude of the wave emitted varies according to the variations in the sound waves applied.

In another form of plate modulation circuit, the resistance of the plate circuit of the oscillation valve is varied by the alteration of grid potential of the modulator valve, brought about in the same manner as in the first circuit quoted, thereby varying the power applied to the oscillation valve, and consequently the amplitude of the wave emitted, as before.

These types of modulators are suitable for distant control.

Grid modulation is produced by varying the steady potential of the grid of the oscillation valve by means of the microphone.

As grid modulation is extremely critical of adjustment, it is not suitable for distant control or high power transmission.

(To be continued.)

Securing Regeneration with a Home-Made Tickler Coil

BY following the directions given in this article an experimenter may make his non-regenerative set regenerative, or he may convert his two-coil regenerative circuit into a three-coil circuit, a circuit which finds more favour than the simpler two-coil circuit.

The three-coil circuit is to be preferred, amongst other reasons, because it minimises the chances of causing interference. In this connection it might be noted that the British Postmaster-General will not sanction the use of a set where the regenerative circuit is directly coupled to the aerial circuit.

Directions are given herein for the construction of a simple home-

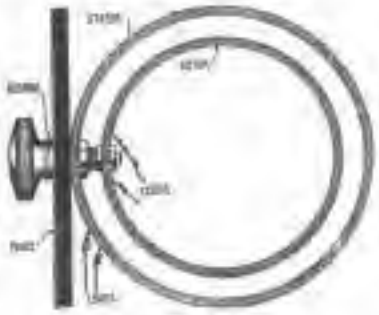


FIG. 1

How the Home-Made Tickler is Mounted.

made variometer, or to be correct, an inductance of the variometer type, to be used as a tickler for producing regeneration.

The special feature of this variometer type inductance is that the rotor and the stator (the moving portion the rotor, the fixed part the stator) are not coupled together in series as in the ordinary variometer.

Using this special type of inductance one experimenter claims to have achieved very high efficiency in his receiving set by taking the grid circuit, lead from the aerial circuit, as is usual in the two-coil regenerative circuit, and adding the special inductance in the position shown in the diagram, Figure 2, as an additional regenerative coil or tickler. That is, that both the secondary of the vario-coupler or loose coupler act as one tickler coil, and the special variometer type inductance as a second tickler coil, and this he terms a "double regenerative" circuit.

By constructing the special variometer type inductance, two very interesting experiments may thus be carried out.

But let us see what regeneration means.

Regeneration, briefly, is a method of securing amplification with a single tube, by coupling the output of the bulb back to the grid in such a manner that it intensifies the slight potential applied to it by the incoming wave, the strength of which determines the audibility of the signal.

An incoming signal is impressed on the grid of the vacuum tube as a certain variation of a positive or negative charge, or by either repelling or attracting the electrons flowing from filament to plate. It varies the strength of the plate current. The plate or space current passes through the receivers or the primary of an amplifying transformer, the high voltage battery, and finally across the elements of the tube. As the changes are thus caused by grid variations, it holds that the grid and plate fluctuations occur practically simultaneously, the change in the plate current being, in fact, nothing more than an intensified replica of the grid variations. Thus, if a part of this energy in the plate circuit is properly transferred back to the grid circuit, it will augment the like variations there with a resulting greater change in the space current. This again reacts on the grid, and regeneration may be continued up to a certain point at which the circuit is said to oscillate. (The ultra amplification in the Armstrong super-regenerative set is secured by carrying out this feed-back principle considerably further, and effecting regeneration far past the stage at which conventional receivers commence oscillating.)

Regeneration may be obtained in either of two ways—by inductive or by capacitative feed-back, each system functioning, as its name implies, by the receptive means of inductance and capacity.

Induction feed-back is the simpler system, and its action more easily understood. It consists of a coil of inductance in series with the plate battery and phones, coupled to another coil in the grid circuit, generally the secondary of the vario-coupler or its equivalent. Any receiver can thus be made regenerative by the installation of a "tickler" system, built up in the form of a small variometer with no electrical connection between the rotor and stator. Two cardboard tubes should be secured, one the stator, approximately three and a half inches in diameter, and the second, of such a size, about three inches, that a one-inch length of it will turn within the stator. Ten turns of any convenient insulated wire is wound on the stator, and twelve turns on the smaller

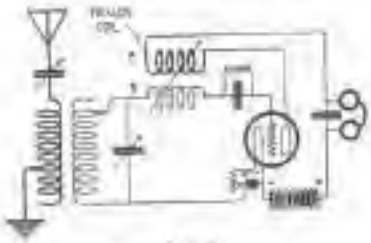


FIG. 2

The Circuit Employing the Special Variometer Type Inductance.

tube, the rotor. The experimenter may mount the tickler as his ingenuity suggests, but a switch knob, minus the lever, and a bushing, probably afford the simplest method. Figure 1 shows how the stator is clamped under the nut of the bushing, while the revolving tube is held between the lock nuts on the switch shaft.

The diagram for including the tickler unit in the conventional valve circuit is shown in Figure 2. In any circuit, one coil, generally the stator, is connected in series with the grid condenser on the A Battery side, and the remaining coil, between the receivers and the plate.

Tuning is effected in the usual manner after having first set the coils at right angles to one another. When the station is tuned to maximum loudness, the tickler is brought into play by turning the rotor in the correct direction (to be determined by experiment). As this is done, the signal strength will increase un-

till just before the circuit oscillates, beyond which point reception will be distorted and unsatisfactory. Except for continuous wave—C.W.—signals, which are the most commonly received on an oscillating set.)

The tickler unit just described will give regeneration over a range of wavelengths up to six hundred meters, above which, larger coils must be made.

Regeneration by capacitative feedback finds its most popular modification in variometer sets, where it is accomplished through the capacity between the grid and plate elements of a valve. However, as is easily understood, the capacity between these parts of a valve is very small, and to achieve an appreciable transfer of energy requires very careful adjustment of the two circuits—an adjustment that is effected by the variometers. Efficient transference of energy from one circuit to another is possible only when the two circuits are in resonance, or tuned to the same wave. Variometers, which are continuously variable tuning units, make it theoretically possible to arrive at this ideal condition.

This last type of regenerative set is the most efficient short-wave receiver, because, on higher frequencies (short waves), resonance plays a much more important part. Due to the variometers, complete resonance is sustained throughout the set, from the aerial through the plate circuit, thereby utilising to the utmost the barely perceptible current of the incoming signal, as well as gaining an initial amplification by regeneration.

Two small variometers may be wound in the manner described for the construction of the tickler unit, except that the rotor and stator are connected, leaving only two open wires from each variometer. These variometers may be added to almost any non-regenerative set, by connecting individual variometers in place of the rotor and stator coils indicated in the tickler hook-up (i.e., one variometer in the grid circuit, and one in series with the telephone receivers).

Tuning with a variometer set requires considerable practice, but once the operator becomes accustomed to the peculiarities of his apparatus, the remarkable reception will repay him for his efforts. The grid variometer will require certain definite settings for different wavelengths (which must be determined by trial), and should be first set on the wave adjustment for the signal it is desired to receive. The plate variometer is set at any non-oscillating position, and the station tuned by varying the aerial condenser or inductance. When the station is tuned in, generation is controlled by manipulating the plate variometer. The final adjustment is a very delicate tuning of the grid variometer.

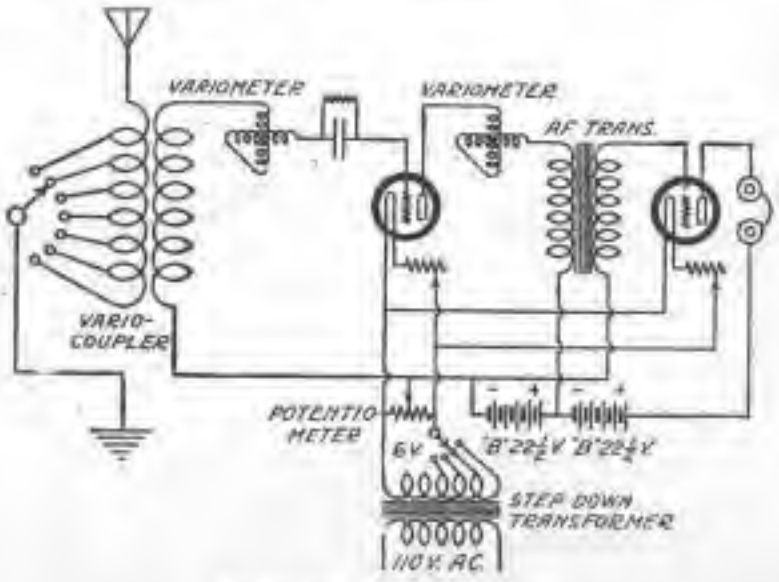
Transformer *v.* Storage Battery

HERE is a circuit in which the ordinary house lighting, a.c. current is used for the filaments. A toy transformer, such as is used for running electric toys, is employed to step down the voltage to 6 or 8 volts. The type known as the heavy delivery type, toy transformer is necessary, as the very light delivery transformers do not supply quite enough current. These transformers are usually tapped for 6, 8 or 14 volts. In practice the 8 volt tap was found to be correct for valves normally taking 5 to 6 volts.

The 6 volt tap should be tried first, however, and if not sufficient, the 8 volt tap should be cut in, with the rheostats all in, and then the rheostats should be gradually cut out until the right position is found where the filament is lit to just the right brilliancy.

In the diagram a potentiometer is included in the circuit. This is for the purpose of eliminating the a.c. hum, which practically disappears, when the potentiometer is connected up in the manner indicated. The potentiometer is placed across the terminals of the transformer, that is, across the terminals actually in use, and the slider is connected to the negative side of the "B" battery, the connection being continued to the vario-coupler secondary on the one side, and to the secondary of the audio-frequency transformer on the other.

As the step down toy transformer, of the heavy delivery type, costs but a few shillings, it may prove a very much cheaper method of lighting the filaments than that of using a storage battery.



The Step Down Transformer in Circuit.

Wireless Pars from Everywhere

WIRELESS WAVES AND WALNUTS.

THE kind of man who can write the Lord's Prayer on a threepenny bit finds his prototype in the radio world in the individual who devotes his energies to experimenting in the production of a wireless receiver which will fit into the smallest possible space. Sydney, N.S.W. has discovered her radio genius in this respect, and he has made a crystal receiver which fits into a walnut shell. Hence our heading.

* * *

THE COMING WIRELESS EXHIBITION.

ABOUT June next a Radio Exhibition is to be held in the basement of the Sydney Town Hall. This will be the second Radio Exhibition to be held in this city, and it will be interesting to note the strides which have been taken in the matter of popularising radio since the first Australasian radio exhibition was held in September of last year.

The exhibition is being organised by the New South Wales Division of the Wireless Institute of Australia, which body has appointed a committee to carry out the preliminary organising, and Mr. O. F. Mingay, Radio Manager for The Burgin Electric Co., Kent Street, Sydney, has been made Hon. Secretary.

The date has been fixed well ahead to allow many of the firms to lend radio equipment which is now on order. Broadcasting programmes will be given during the course of the exhibition.

A number of special prizes are to be allotted to the successful competitors, either individuals or clubs, for the best amateur made apparatus.

* * *

NEW ZEALAND WIRELESS.

MR. J. G. COATES, the Postmaster-General (New Zealand) has informed Parliament that the Government is considering the establishment of a high-power wireless station.

It has not yet been decided whether New Zealand will have a system directly communicating with Great Britain, or whether it will be a link in the Empire wireless chain.

RADIO TELEPHONY ENGINEERING AS A PROFESSION.

PROBABLY there is no profession at the present time which offers such opportunities to young men and women as that of radio engineer. The whole science is in its veriest infancy and its scope is absolutely unlimited. The student of to-day, by a series of fortuitous circumstances leading up to the discovery of an important invention, may to-morrow be a world-famous radio engineer.

Stott's Technical Correspondence College is an institution where close attention has been given to wireless subjects for many years, and branches have been established at Melbourne and Brisbane.

During the war many trained operatives in wireless telegraphy and telephony owed their rapid advance to the practical training received at Stott's, and students availing themselves of the up-to-date course in radio engineering, now being given at all the branches of the college, will not only fit themselves to obtain their licenses, but will be laying the foundation of what may prove to be a very successful career as a radio engineer.

* * *

EXTENDS RANGE OF COAST DEFENSE GUNNERY.

EXTENSION of the range of coast defense guns is the newest service performed by radio. Experiments with a new use of the radio compass, recently carried out by the U. S. Army and Navy, has indicated, as unofficial reports state, that radio will enlarge the effective range of the big guns. Heretofore, the giant cannon on the American coasts have been limited in range to the limit of visibility at sea, which was about 25 miles under the best conditions. The guns can shoot twice that distance, but as the target cannot be seen further than that, their extra range is useless.

However, it has been found that if an airplane flies directly over a ship at sea, at the same time sending a series of radio signals, radio compass stations on shore will be able to spot the exact location of the plane, and therefore of the ship.

MME. TETRAZZINI—RADIO AMATEUR.

MME. TETRAZZINI was so interested at the London Wireless Exhibition that she purchased a four-valve receiver, and she has certainly picked on a first class instrument.

* * *

THE LATEST.

A SLOT machine for the development of broadcasting has been invented in America, and tested officially by the Bureau of Standards. It consists of an automatic apparatus, with an exterior not unlike a post office stamp slot machine. It is claimed that the machine is "fool proof." When the coin is inserted in the slot at the top (at a time when the broadcasting news intimates a programme is being sent out) two lights are automatically switched on, and the music is heard through a horn born at the bottom of the instrument.

* * *

BRITISH WIRELESS TELEPHONE EXCHANGE.

WHAT is said to be the first wireless telephone exchange in the world has recently been established at Croydon, England, the point from which the aerial lines to the European Continent take their departure.

The chief use made of this exchange is to connect the aerial traffic controller, who has his headquarters in a control tower at Charing Cross, London, with the pilots of the air express flying between Croydon and the Continent of Europe.

This wireless exchange can also connect the airship, while in flight, with any office of the aerodrome at Croydon.

The pilot of each aerial service is now required to report his position to the traffic controller every fifteen minutes so that the progress and position of each machine is known throughout its journey. The controller is of particular use in directing the course of the airships in times of fog, and in giving them special directions for landing.

The traffic controller also, from time to time, broadcasts from his wireless telephone weather reports to all machines in sight.

JAPANESE RADIO AND CABLE OPERATIONS.

JAPAN proposes to come to an agreement with the Chinese Government as to the disposition of the radio stations at Tsingtau and Tsinan and to arrange for the continued operation of the submarine cables between Tsingtau and Sasebo, which were part of the communication system developed and administered by the Germans but taken over by the Japanese during the war.

The proposed changes in operation of cable and radio will be in accordance with the provisions of the recent treaty, which covered the restoration of Chinese communications to the Chinese Government in a large measure. That government is disposed to co-operate with private foreign capital in the development of the cable and radio systems in China, but the sense of the treaty provision is to prohibit the handling of commercial telegraph business by any means from China through the agencies of foreign governments. The American radio stations at Peking and Shanghai will eventually be closed to commercial traffic, although permitted to handle American and Chinese Government messages. Plans are under way for the establishment of a high-power commercial radio station by an American company.

* * *

WIRELESS FOR ALL.

UNDER the above title Mr. F. J. Grat, manager of the Electrical and Radio Department of Messrs. Grace Bros., Broadway, Sydney, N.S.W., has published a booklet which contains some very useful information for those about to purchase radio receiving or transmitting apparatus. Included are a resume of the Wireless Regulations, and hints on how to obtain the necessary license, erecting aerials and installing sets; what to buy to suit the various requirements; how to tune in; adding amplifiers and loud speakers, and prices and particulars of crystal and valve receivers, headsets, loud speaker horns, condensers, and the full gamut of radio accessories. The price is 6d., posted, and it is a publication which should be on every experimenter's shelf. The style is lucid and effective, unnecessary technicalities being studiously avoided.

WIRELESS FOR CANADIAN WOODS.

PLANS are being completed for a chain of wireless stations extending right into the Arctic Circle in Canada, linking together the most distant posts, and enabling Canadian officials to communicate with each other instantly, instead of by the old method of sled-carried mails. The new wireless chain will be operated by the Dominion Government. Stations are to be operated at Forts Smith, Resolution, Simpson, Norman and McPherson on the Mackenzie and one at Dawson City.

MR. LE QUEUX'S LATEST.

MR. WILLIAM LE QUEUX, the master of the mystery story, has written the first novel to be cast in the atmosphere of wireless telephony, a subject with which Mr. Le Queux is thoroughly familiar, for he was one of the early amateur experimenters in wireless, the owner of the first amateur wireless telephone installation in Great Britain, and he is a member of the Institute of Radio Engineers. The novel, which will be called "The Voice from the Void," will be published by the House of Cassell on the 16th inst.

Winner of the First Novelty Photo Prize

Wallace Nelson, of Queensland, and his friends "listening in."

THE BURIAL SERVICE BY WIRELESS.

THE Canadian Government steamer "Canadian Trooper" was at sea, and when a fireman died it was found that there was not a prayer-book on board.

The captain wirelessed, asking for aid, and his call was picked up by the Cunard liner "Carmania" off the Irish coast. The operator on board the liner immediately wirelessed the full order for a burial at sea, which was taken down by the operator of the "Canadian Trooper." This was used by the captain when the body was committed to the keeping of the deep.

THE GREAT INVENTION.

MR. JOHN HAYS HAMMOND, who recently declared he had invented a "secret wireless" device, states he has been at work on his important problem for the past fourteen years. He promises actual secrecy to wireless work, and that it will be practically impossible for any other than the proper receiving station to hear anything but a confused jumble.

His apparatus is quite simple, according to the "Radio World." The same wave sent out from a station may be made to carry several messages at the same time, and both voice and code may be transmitted, so the inventor claims.

MELBOURNE POLICE EMPLOY RADIO.

PARIS, Chicago, New York and other large centres of population have had radio equipment for their police for some time.

Melbourne has just initiated a radio communication service between a station in the Domain and the night patrols. The outfit includes a super-schellive receiver with a loop aerial, carried on a frame in the patrol waggon. The usual telephone receivers are employed, but it is reported that the reception is so loud that the radiophonad orders can be heard all over the patrol waggon with the telephones resting on the receiving apparatus. By the new method, a patrol waggon can be hurried to any desired spot within a few minutes—an innovation the criminal class will not quite appreciate.

* * *

ENGLAND AND AUSTRALIA.

AN English radio enthusiast who was in Australia on a long visit has now returned home and writes to a Sydney friend to tell him what the radio position is in England at the present juncture.

He says that he found the wireless boom in full swing, radio getting plenty of publicity in all the newspapers, and, in consequence, the ranks of the amateurs were being reinforced by large numbers from day to day. Wireless societies were springing up on every hand, and there was no lack of members available immediately the societies were formed.

He reports that there has been a great rush on all kinds of wireless apparatus, and that it was exceedingly difficult to obtain such things as telephone receivers.

A good deal of broadcasting was being carried on, some of it poor, but everybody was waiting for the Broadcasting Company to start its regular service.

Concerning the attitude of the British authorities towards the amateur experimenter, he says—"Conditions here contrast strangely with those in Australia. Here a man may put up an aerial and get a license without being looked upon with suspicion.

"Nor is he regarded as a crank by the general public.

"Despite the fact that amateurs are so free from restrictions by the authorities, there is, as far as I can ascertain, no interference with commercial work."

* * *

SUNDAY NIGHT CONCERTS.

MANY Sydney amateurs have missed Mr. Maclurcan's Sunday night concerts for the last eight or nine weeks. Even an enthusiastic radio experimenter has to take a holiday occasionally, and Mr. Maclurcan is no exception to the rule. However, he is now back in town, and the Sunday night concerts have been resumed, much to the delight of "Charlie's" many friends. Listen in on 1400 metres, Sunday nights, 7.30 to 9.

* * *

SUNDAY MORNING CONCERTS, TOO.

GARDEN ISLAND is doing some experimenting in transmitting music, etc., on Sunday mornings from 10.45 until 11.30. The wavelength is 1550 metres, and an enjoyable concert may be anticipated by radio experimenters who stay home from church to put their radio gear in order.

* * *

ABOUT OURSELVES.

THE Australasian Wireless Review has at once jumped into favor all over Australasia as a journal devoted to the wireless art, which hits the popular taste. Congratulatory letters have come in from all points of the compass; from the extreme north of Queensland, from as far west as Perth and Broome; from South Australia, Victoria, Tasmania, and from the far south of New Zealand. Practically all our correspondents used the phrase (or its equivalent): "Just what was wanted."

Naturally we are pleased to know that our efforts have met with such general approbation, but we will be more pleased when you all realise that we want the Review to be a link, binding together in one common fellowship all the radio experimenters, clubs and societies, of Australasia, in that spirit of co-operation which will prompt all and sundry to exchange news, views and opinions. There is some one in every city, town and hamlet who can let us know what is doing in the radio field in their district. Just a brief line or so saying what is being received and from what distances; who are carrying out the reception and with what apparatus; what persons or clubs are transmitting and at what hours and on what wavelength; and so on.

In short, keep us informed in order that we may have the information to pass on, through the Review, for the benefit of all.

* * *

ADVERTISING PAYS.

DAY before yesterday we called upon a radio dealer—one of the Review advertisers. Grabbing us by the sleeve, he led the way to the back of the store. Pointing to a pile of parcels ready for despatch, he said that every order in the pile was an order resulting from his advertisement in the Review. Needless to say, he is a "permanent." He is getting results!

The Review goes into every newsagents, in every portion of Australasia. Not one little township is missed. We have attended to the production of the Review. The distribution question was one for experts with expert distributing organisation.

The Review is distributed by the recognised distributors of Australasia.

Our advertisers therefore get service, the best of service.

A page of advertising may be dear at £1 per issue. It may be cheap at £10 an issue. There are journals with pages the same size as the Review that charge £150 per page per issue.

In that case you need a particular kind of service, and you pay for it.

If you are handling radio goods, or electrical goods, you will get the best of service in the Review at a rate commensurate with the service you desire. If you intend to give the radio public a square deal, we will accept your advertisement with pleasure—not unless.

Don't stock up with radio goods and expect people to be clairvoyants. Let the people know you have radio stocks by an advertisement in the Review. ADVERTISING PAYS!

Electricity and Life

By FREDERICK FINCH STRONG, M.D., Lecturer on Electro-therapeutics, Tufts Medical School, Boston.

Foreword:—We commend the following article to the close attention of our readers, as Dr. Finch Strong is the greatest living authority on the construction of High Frequency Coils.

We have personally made up coils from Dr. Strong's directions, and they have proved highly efficient.

Until you have handled high frequency apparatus you cannot fully grasp the action of currents of high potential and high frequency such as are used in wireless communication. A Tesla coil made up on Dr. Strong's directions costs next to nothing, and it reveals wonders in electricity never dreamed of by those who have not had the experience of handling such a coil.

HIGH-FREQUENCY currents, when properly tuned, act as "Vital Boosters," increasing all the functions of the body and helping it to resist and throw off disease. This

Fig. 1. View of the Strong Clinical Tesla High Frequency Coil Delivering a Veritable Tree of Sparks Several Feet in Length.

vitalising effect is not due to the mere liberation of heat in the tissues, for it is produced by the very high-voltage ("Tesla") currents as well as by the heavy amperage ("D'Arsonval") currents from which the thermic effects are usually obtained.

When the writer demonstrated the first therapeutic Tesla Coil and the first Vacuum Electrode—(in 1894 before a Boston Medical Society)—and suggested that this method was destined to come into general use as a vitalising agent, he was laughed at by his colleagues, yet to-day there is scarcely a well equipped physician's office in this country or in Europe that does not contain some form of

The Construction of High-Freqency Apparatus for Medical and Lecture Use.

therapeutic high-frequency apparatus. Even the barber shops of the present time have their small "Violet Ray" outfits, and these are not by any means "fakes," for they produce real results, such as the relief of headache, neuralgia, skin diseases, etc.

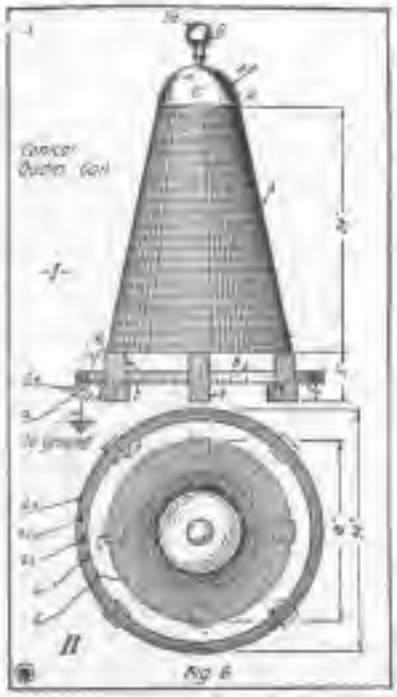
Unlike other forms of electricity, these currents may be administered to patients with perfect safety. In twenty years' experience in electro-therapeutics the author has never known of harmful results from the use of Tesla Currents applied through a vacuum electrode. The heavy amperage ("D'Arsonval") currents, owing to their deep thermic effects, should be used only under the direction of a physician. The writer is a

Fig. 2. Another View of the Strong High Frequency Coil Producing a Perfect Sheaf of Flashing Sparks to a Grounded Conductor. The Exciting Energy is but 1 Kilowatt.

firm believer in the use of Tesla currents in the home—if each member of the family could receive ten-minute daily treatments from a small high-frequency apparatus, the general standard of health would be greatly increased. This has been demonstrated in hundreds of cases.

The author has interviewed a number of the more prominent authorities on medical electricity, and they agree as to the vitalising effects resulting from daily high frequency treatment.

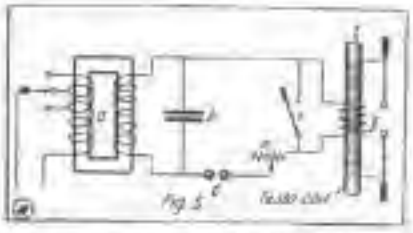
Anyone who possesses a ½ or ¼ K.W. wireless (raise former, operating on 100 volt, 60 cycle A.C., can



Details Are Given in This Article for Constructing a Reliable and Powerful Quilo or Tesla High Frequency Coil, Suitable for Physicians' Use. This Type of Coil is the Most Efficient Ever Designed.

easily construct an efficient high-frequency outfit for medical or lecture use. The complete equipment includes a .01 microfarad glass plate condenser, Tesla coil, inductance, spark gap and electrodes.

The Tesla coil is made as follows: (Fig. 3), on a paper mailing tube 2½in. diam. and 14in. long wind 480 turns of No. 34 D.C.C. copper mag-

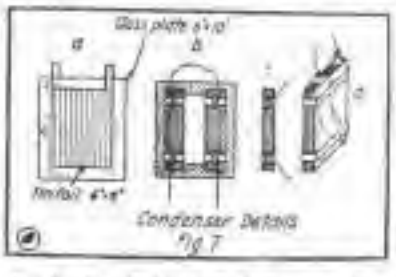


Connection Scheme for Tesla Coil "T. C." Showing Switch "S." Tuning Inductance "d," Spark Gap "G," Condenser "C," and Step-up Exciting Transformer "E."

net wire. Set up the tube in the lathe, apply a coat of orange shellac, spin on the wire, apply a second coat of shellac and allow to dry thoroughly. The winding occupies 12 inches, leaving a margin of 1 inch on each end of the tube. Leads of light auto (ignition) cable are soldered to the ends of the winding. A strip of waxed, corrugated paper M. 5in. wide is wrapped around the centre of the secondary tube, and on this is wound the primary, consisting of four turns of heavy tension auto cable, and thoroughly secured by tape; at least a foot of cable should project from each end of the winding to form the primary leads. Place the coil in a wax light box made without nails and embed it in a mixture of four parts resin and one part beeswax. It is safer to boil the coil for an hour in the insulating mixture before placing it in the box. Coils made in this way by the writer are still giving good service after fifteen years of use.

The greatest source of trouble in a medical high frequency outfit is the spark gap; the one described below is the outcome of many years' experiment. If properly made it will run daily for months without deterioration. The spark takes place between two pieces of brass rod 1¼in. diam. and 3½in. long, turned and shaped as shown. The sparking surfaces are turned in annular grooves with a 60 degree tool. If your lathe has an automatic cross-feed you may set it to twenty turns to the inch, and turn a spiral groove instead of the annular rings. After finishing, the brass pieces are heavily silver-plated and mounted in the usual manner as shown. (Fig. 4.) For currents over 1 K.W., a plate of silver should be soldered to the brass before turning the grooves. This gap will also give greater efficiency in wireless work as compared with the usual stationary gap.

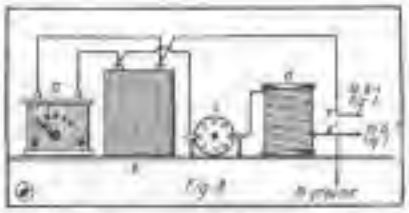
The connections for the various parts of the apparatus are shown in Fig. 5. An important feature is the use of an external inductance or tuning coil "d" in series with the Tesla coil. It consists of 32 turns of No. 8 bare copper wire, wound on a frame 8in. diam., with ¼in. between turns. Edgewise wound flat copper strip is better, but more expensive. (d Fig 8.) This coil when used in series with the Tesla primary enables us to tune the oscillating system to perfect resonance when the capacity of the patient's body is added to the Tesla terminal. Effects are produced which are impossible with any other method. The beautiful High-frequency Effluve or brush-discharge, so valuable in treating pulmonary diseases, and which no few modern high-frequency machines can produce, is obtainable by the use of this series inductance. It may also be used, by short-circuiting the Tesla primary, as an auto-transformer from which may be derived



Details for Building High Tension Glass Plate Condenser to be Connected in Tesla Coil Circuit.

heavy "D'Arsonval" and "Diathermic" currents as described in the next article of this series.

For stage demonstration and public lecture work the writer employs a large high-frequency resonator which produces a tree-like discharge three feet in diameter (Fig. 1.), and gives a heavy arc over two feet in length. (Fig. 2.) This shows remarkable efficiency when it is considered that the resonator is excited by a "Type E" transformer drawing only 1 K.W. and a condenser of but .01 m.f. capacity. A small rotary spark gap is used such as is supplied by the E. I. Co. This result is made possible by the use of the separate inductance in series with the resonator primary (exactly the same as that described in connection with the



Method of Connecting Transformer, H. T. Condenser, Rotary Spark Gap and Tuning Inductance "d" in Large Oudin Coil.

therapeutic apparatus), (d Fig. 8). The writer believes his resonator gives the most spectacular discharge ever obtained from 1 kilowatt of energy.

Ordinary plate condensers are used, made from 8 x 10 inch flexible glass, coated on both sides with tin-foil 6 x 8 inches (a Fig. 7.) Six pairs of plates assembled into a unit and boiled in wax give a capacity of .01 m.f. For safety it is better to employ four of these sections connected in pairs of .02 m.f. each (b Fig. 7). To run this resonator at full power for long periods of time it would be safer to use a series multiple condenser consisting of three sections of .03 m.f. each in series. Such a condenser would contain 108 —8 x 10 inch plates, and would be expensive, bulky and very heavy. For this reason the writer has found it much more convenient to use a single 12 plate (.01 m.f.) condenser across the transformer secondary and to replace it when it punctures. The large resonator was operated for six months in lecture and experimental work before a condenser section broke down.

The cone for the secondary of the large resonator is of heavy paperboard, and was built for the author by Bickrell and Fuller of Boston. Its dimensions (see Fig. 8) were suggested by Mr. Earle L. Ovington, the cone being similar in shape to those used by Mr. Ovington in the

New York Electrical show several years ago. Any amateur can make a cone of this kind by superimposing strips of heavy paper, soaked in

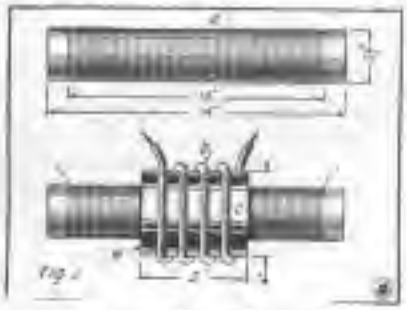


Fig. 1

How small Size Tesla Coil for Medical Treatment is Built. "P" is the Primary, "S" the Secondary.

paste, over a wooden framework. The secondary winding consists of 400 turns of No. 27 D.C.C. copper magnet wire. Two parallel strands of wire are wound on in the same, the adjacent turns in contact; after winding, one strand of wire is removed, leaving a space equal to the diameter of the wire between each of the 400 turns. The cone and winding is then treated with several coats of "Aruralac" (ordinary shellac will not answer).

The primary consists of five turns of thin copper ribbon 1 inch wide, 1-8 in. paperboard strips being placed between the turns. The diameter of the coil is 24in. When completed it is taped and roasted in a pan of melted wax until thoroughly impregnated. The terminal shown in the photographs is made from a large brass oil-can, the stem being removed and replaced by a 3in. brass "bed-ball." The terminal is not attached to the coil, but simply rests on its upper surface in contact with the end of the secondary wire. The primary and secondary are separately supported by suitable wooden blocks; the coupling is rather loose, the bottom of the resonator being at least two inches above the primary. The lower end of the secondary coil is attached

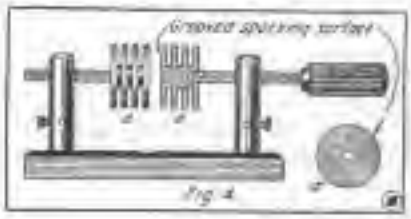


Fig. 2

Unique Stationary Spark Gap Having Adjusted Points, as Devised by Mr. Strong.

to the inner primary terminal and grounded.

Perfect resonance is obtained by varying the number of turns in the inductance coil in series with the primary. (Fig. 3.) This tuning system enables us to perform many brilliant experiments otherwise impossible, such as illuminating wires stretched across a lecture hall, lighting an inverted umbrella, etc.

The Passing of the Tom-Tom

The Kingdom of Tonga adopts the Telephone

No longer do the booming beat of the tom-tom or the musical tones of the tribal crier summon the sworthy sons and daughters of the famous South Sea Islands to their festive gatherings. The telephone has finally made its way into the great Pacific Archipelago and has come to stay in the little kingdom of Tonga. Already the natives of the three large islands and the 300 smaller ones which make up the Tonga group have become almost as accustomed to the mysteries of the "talking wire" as their more effete friends of the Occident.

The telephone system just installed in Tonga by the New Zealand representatives of the International Western Electric Company is one of the smallest in the world. It consists of a little less than a hundred subscriber lines, most of which are located on the main island of the group. Later, as the natives get more familiar with their new utility, it is probable that extensions in service will be made to most of the outlying settlements in the 300 odd square miles of scattered islands included in the kingdom. Although they have been at it only a short while, the native belles employed as switchboard operators at the Tonga exchange have acquired an efficiency that is almost unbelievable.

Unusual difficulties beset the engineers sent to Tonga to instal the system. Most of the islands lie so low in the water that it was almost impossible to dig holes for the telephone poles. On the main island, which is nothing but coral formation six feet above sea level, it was necessary to brace up each pole with specially prepared blocks and to give each of them an extra coat of tar as a protection against the elements. As the cocoanut trees, which form the only wood supply of the island, are not strong enough to bear any additional burdens, all the poles used for the lines were imported from New Zealand.

It proved almost impossible to get any unskilled labor for the less important phases of the project. In fact, the native males have such a natural antipathy to work of any sort that it was necessary for the Tongan Government to supply a gang of ten prisoners from the local gaol and an interpreter to aid the Western Electric representatives.

Another condition that handicapped the completion of the job was the scarcity of horses in Nukualofa, the Tongan metropolis. The problem was finally overcome when the engineers and their government friends commandeered a handcart, which, after being considerably strengthened, served as the sole means of transporting all over the kingdom the heavy equipment used in the system. Anglo-Saxon ingenuity also came in handy in devising special tools for the native workmen, who, because of their lack of footwear, were unable to manipulate the usual type of long shovels used in pole-hole digging.

In their report on the completion of the Tonga telephone system the engineers attribute most of the difficulties which they met in their attempt to advance the cause of civilisation in the islands to the Utopian occupations of the natives. Practically all of the time in Tonga is spent in church going, beetle hunting, attendance at movie shows, swimming and eating. In between whiles, when they happen to think of it, the more ambitious Tongans do some work on the cocoanut plantations.

Making Condensers

THE average beginner who is about to make up his own condensers will, first of all, decide the size of condensers he is going to use, and will then set about obtaining the necessary data to enable him to make up the condensers required. In this the following table will be helpful: —

For Variable Condensers.

Capacity.	Number of Plates.
.00015	5 fixed, 4 moving
.0003	9 " 8 "
.0005	13 " 12 "
.001	22 " 21 "
.0015	30 " 29 "

The above table is based on the assumption that the plates are 2½in. in diameter, and that the air space between moving plates and fixed ones is 1-16in. In calculating the area of the plates, only the area of the moving plates is taken into consideration. The first three sizes are used as grid condensers; the third (.0005) is used in the secondary circuit sometimes, and the others, .001 and .0015, are used in the aerial tuning circuit. The .001 condenser is used in both the secondary and plate circuits in a standard honeycomb coil system, as well as in the aerial tuning circuit. The De Forest circuits all have the .0015 condenser in the aerial tuning circuit, and it is all round, a very satisfactory condenser for that purpose, having its advantages, whether used in series or shunt.

Having decided upon the size of condenser to be constructed, the next thing is to obtain the necessary materials. If the instrument is intended for table use—that is, not to be incorporated in a panel, two discs of quarter-inch thick ebonite will be required. These are obtainable with three holes drilled in them for the spindles of the fixed plates. There will also be a 3-16in. hole in the centre of the discs, and this is where the amateur's troubles begin. The spindle carrying the moving plates should not be less than a quarter of an inch in diameter, and it is obvious that this will not pass through 3-16in. holes. The disc intended for the top plate of the condenser must have the centre hole enlarged to allow the quarter-inch spindle to pass through it without any "wobbling." The hole in the bottom disc remains 3-16in., the ¼-inch moving spindle being turned down at one end for a length of three-eighths of an inch to the 3-16in. diameter. This forms a "shoulder" between which and the ebonite disc, a thin brass washer, with a 3-16in. centre hole can be placed for a rotating bearing for the moving spindle. The quarter-inch moving spindle will be screwed for a portion of its length to allow the moving plates to be clamped right when they are in position. The part of the spindle which goes through the top disc must not be screwed, as it forms a bearing in the ebonite to keep the moving plates in true alignment. It is therefore very necessary to see that the screwing is done far enough to clamp the plates properly, but without being so far as to encroach on the "bearing" space. For a .001 condenser, the screwed part of the moving spindle should be exactly 2¾in. long, starting from the turned-down shoulder already mentioned. The unscrewed part of the spindle above the threaded portion should be one inch in length to allow of bearing room in the disc and for the purpose of attaching the knob and dial. The total length of the moving spindle should therefore be: 1in., 2¾in., ¼in.—altogether 4¼in. over all.

For a .0015 condenser, the same shoulder is turned in the bottom of the quarter-inch-diameter moving spindle; the spindle is threaded or screwed for a length of 4¼ inches above the shoulder, and 1¼in. is the length allowed to be unthreaded to form the bearing and carry the knob and dial. Total length,—¼in., 4¼in., 1¼in.—altogether, 6 inches is the length of the moving spindle for this size of condenser. For a .0005 the same shoulder is turned on the bottom of the moving spindle, the screwed portion should be 1¾in., and allow one inch to form the bearing at the top and carry the knob and dial. Total length of moving spindle, ¼in., 1¾in., 1in.—altogether, 3¼in.

The spindles for the fixed plates in all sizes of condensers are screwed for the whole length; one cannot conceive why. They should be screwed three-quarters of an inch at each end only.

As to the length of the fixed plate spindles, some trouble is experienced in this connection, as they are often supplied too short.

For a .0015 condenser the fixed spindles should be 5¼ inches in length. For a .001 they should be 4¼ inches long, and for a .0005, 3¼ inches.

In addition to the three spindles for the fixed plates there should be a fourth one to support the opposite sides of the discs and to keep them rigid and true. The two discs should be bolted together with the fixed plate holes in true alignment and the fourth hole drilled in both discs, simultaneously, so as to be in true alignment also. In the top disc two holes will be required to allow the connecting terminals to be fixed. One of these should be half an inch outwards from one of the outer fixed plate spindles, and the other one should be half an inch from the fourth or strengthening spindle. These holes should be one-eighth inch diameter.

The following materials will be required for the various sizes: —

Size of Condenser.	Fixed Plates.	Moving Plates.	Large Washers.	Small Washers.	Spindles, Moving.	Spindles, Fixed.
.00015	5	4	6	24	1	4
.0003	9	8	10	36	1	4
.0005	13	12	14	45	1	4
.001	22	21	23	72	1	4
.0015	30	29	32	100	1	4

And two 4in. x ¼in. ebonite discs in each case.

One or two extra large and small washers or spacers have been allowed in all cases, for the purpose of top and bottom connections.

The tools required will be a small pair of pliers, of the cutting variety for preference, a three-inch "ward" file, a six-inch flat file with one side half round, a screwdriver, a soldering iron, solder, and a tin of "Fluxite." As these tools are handy for all purposes they need not be charged up to "condenser account."

The ward file is the type used for cutting keys for locks, and has a very fine cut.

Having procured the materials, the ward file is laid flat on a table, and each spacing washer, large and small, is rubbed on the ward file until all burrs are rubbed off and a good bright surface is obtained on both sides.

The plates are punched out of a number of thicknesses of aluminium and have, therefore, a rough edge on all sides and around the holes. Each plate must be laid flat on a table and the six-inch fine file used on the flat side to gently remove the rough edges. Next heat up the family flat-iron to a good hot degree, place each plate in turn upon a perfectly flat piece of wood or thick glass, bring the centre of the iron down upon the centre of the plate and twist the iron backwards and forwards a few times to get the plates flat.

To assemble, see that the fixed plate spindles are straight. If not, place them on a piece of flat board, cover them with another piece of wood and gently tap them with a light hammer until they are straight, straightening the bulging part uppermost during the process. It will be found to be an advantage to run the nuts on the ward file to take off burrs and to give a bright surface.

Screw a nut about three-eighths of an inch up from the bottom end of each fixed plate spindle. Pass the spindles through the bottom ebonite disc (make sure it is the one with the 3-16th. centre hole), but before going so place a small spacing washer on each spindle so that it will come between the nut and the disc, and then screw a nut on each spindle on the other or bottom side of the disc. A second nut can be added to lock the last-mentioned nut in position. You will now have the bottom disc with the three fixed plate spindles screwed in position and ready to receive the fixed plates. The first plate is now passed over the three spindles, taking care to do this slowly and without scraping the plate. At this point it will be a considerable help to lower the disc and first plate with a small spirit-level. This done, the spirit-level can be applied to each plate as it is put on, and will ensure that all the plates are truly parallel. On top of the first plate place three of the small spacers or washers, but first compare the three washers and select three of the same thickness. The washers will vary slightly, but if they are placed in position in threes of equal thickness the parallelism of the plates may be maintained. When the last plate has been put on top of the pile, place a small spacer on each spindle and then on the top of each spacer, a nut. Giving equal turns to each nut, gradually tighten up the fixed plates on their spindles until they are rigid, but care should be taken not to apply so much pressure as to strip the threads of the spindles.

If the moving plates have been ironed and filed the making up of the moving portion of the condenser may be proceeded with.

By the way, the clamping nuts usually supplied are a quarter of an inch thick, whilst nuts of one-eighth thickness is the utmost that can be allowed. On the quarter-inch diameter moving spindle screw on the one-eighth-thick nut, right up to the top of the threaded portion. Place one of the large spacers next the nut and then put on the first of the moving plates. Proceed in this way, placing in position first two spacers, then the plate, until all the plates are on the spindle. Finally, place a spacer next the last plate and screw on the remaining one-eighth-inch-thick clamping nut.

Gradually increase the pressure until the plates will stay in position and all in line. To keep them in line while screwing, place one flat side of the plates on the edge of the table. If the centres of the plates, projecting beyond the large spacing washers, are now brought to one of the outer fixed plate spindles, starting from the top, it can be seen if the moving plates centres will come exactly in the centre of the fixed plates. See that the centre of the top moving plate comes exactly between the two uppermost fixed plates for a start, and then check the second, and so on.

If you find that the spacing is incorrect, you will have to unscrew the bottom clamping nut, and take off the plates and spacers up to the point where they do not centre with the fixed plates. Before doing so, a note should be carefully taken of the plates which require slightly more or less spacing to bring them to centre.

The writer found it a good plan to obtain some large spacers at another shop, so that the slight difference in size might be utilised in properly spacing the moving plates. Just a few changes in the spacers will bring all the moving plates to the right distance apart to centre properly with the fixed plates. The spacers can be made a little thinner by running them down on the ward file, if this is necessary to facilitate the proper centring.

The next operation is to vary the clamping nuts until the moving plates come into the right position between the fixed plates when the moving spindle bearings are in position.

Trouble will now be experienced with the moving plates touching the fixed ones. When the moving plates are first clamped up they will be found to be out of the horizontal. This is due to the coarseness of the thread with which the moving spindle is usually screwed. The thread, being at an angle, it naturally follows that the plates will be at an angle, too. This is easily remedied, however, as the plates can be bent into the horizontal, and approximately the same distance apart at the edges, by applying pressure with a table-knife. The pressure should be applied with the table-knife over the whole diameter of the plates to avoid buckling them.

After the above operation the moving plates should be fixed in position, the top and bottom discs fitted on, and screwed up tight with their nuts, and by the judicious use of the table-knife the plates may be "tuned" into correct position, at all points, so that they may be rotated without touching anywhere. In "tuning" the condenser it is held up to the light so that the action of the plates may be followed whilst the knob is being rotated. The large size table-knife is best for "tuning" purposes.

The whole operation requires infinite patience, but the reward is worth striving for,—to be able to make up correctly, one of the most intricate and important instruments used in the radio set.

A piece of copper wire connects one of the fixed plate outer spindles to one of the small terminals already mentioned. The strengthening spindle is next fixed in position with a three-eighths-wide thin washer and two nuts at each end on the inner side of the discs, and a similar washer and two nuts on the outer sides. A piece of thin copper wire, or stranded wire, is soldered to the moving spindle at the bottom of the condenser, and is clamped between the washer and nuts at the bottom of the spare or strengthening spindle. At the top a piece of wire connects this spindle with its terminal. As a table instrument, some "feet" will be necessary to lift the condenser off the table sufficiently to clear the nuts, etc., underneath the bottom disc. These are made out of one-inch-diameter ebonite rod, are half an inch in thickness, and are stuck on to the disc by insulating rubber compound.

In addition to the materials mentioned it will be necessary to provide about 18 small nuts for each condenser, the two small terminals and a dial and knob.

It is a little refinement to place a thin three-eighths inch wide washer between all the spindle nuts and the disc surfaces on both sides. If thin copper wire is used for the moving plate spindle connection it should be coiled in the form of a spiral, the shape being that of the hairspring of a watch. About three or four turns are sufficient to give the necessary flexibility.

The Armstrong Super-Regenerative Circuit

JUDGING by the enquiries being made at the radio apparatus dealers for 1500 and 1250 turn honeycomb coils, quite a large number of enthusiastic experimenters are revelling in the fascination of the Armstrong Super-regenerative Circuit, and it only needs one amateur to be completely successful in elucidating its mysteries to set every experimenter in Australasia on the trunk to attain the marvellous results it is capable of.

It is a very wonderful thing to bridge great distances with amateur apparatus using low power, but how much more wonderful to fill a hall, capable of holding 3000 or 4000 people with a Melba Opera, giving all those people the pleasure of hearing beautiful music and gorgeous singing, using a simple apparatus consisting of a three-valve receiver, a couple of batteries and a loop of wire and this at distances up to, at least, one hundred miles radius!

Melba will be here shortly with an opera company picked from amongst the best singers and performers of Europe. She is enthusiastic about broadcasting, and it is certain that she will give every facility to any enterprising broadcasting concern to send out her operas through the ether, just as she did a few weeks ago in London, when half of England heard "La Boheme" broadcasted from the Covent Garden Theatre.

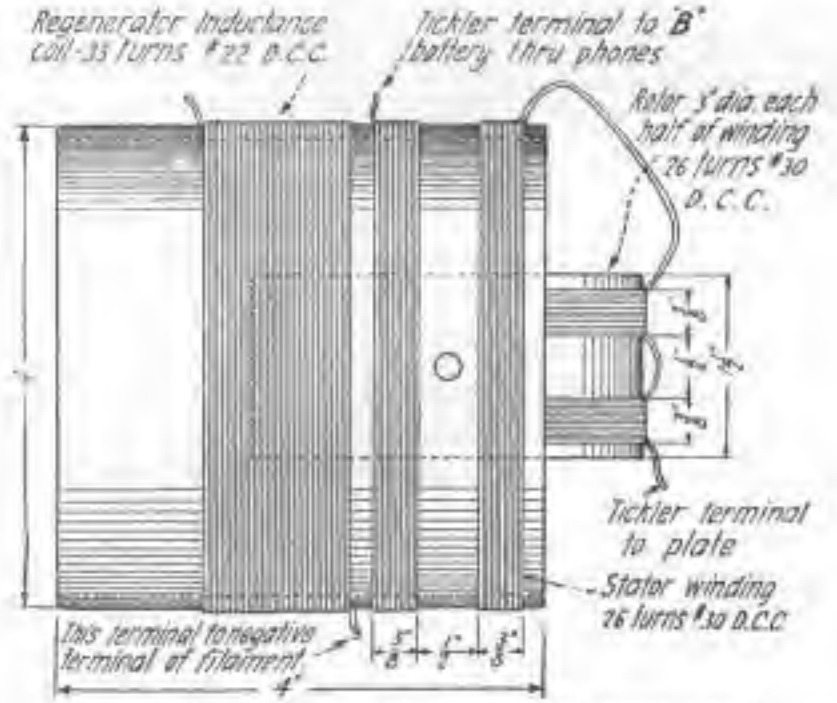
In the March number of the "Review" the writer described the manner in which he had hooked the Super-regenerative Circuit together to test it out. Apparently, it is only a matter of patience and experiment to get the circuit working correctly, as every change reveals some new feature of the circuit that seems to bring one nearer the goal.

Using table instruments, the circuit was wired up according to the modified circuit shown in Figure 1 in the March "Review." When this was done all the characteristics of the circuit demonstrated themselves. First the high pitched thin whistle of the heterodyning was heard. This indicates that the valve in the oscillatory circuit is oscillating. This whistle becomes louder or lighter and shriller when the condenser C is varied, and as the moving plates are turned a series of loud whistles running up and down the scale are heard. Tapping on the grid connection of the reconcerative valve produces the usual double click of oscillation, and this will continue while turning the condenser, in series with the loop, from zero to maximum.

Turning the variometer, a point was found where a tremendous roar was produced, and this could be brought to maximum loudness by varying the filament current of both the first, or regenerative valve, and that of the second, or oscillatory valve. The roar continued while turning the rotor of the variometer through an arc of about 45 degrees, and then became silent. The word "roar" very appropriately describes the noise heard, as it is as loud as the safety valve of a steam engine blowing off. It convinces one that there is tremendous power in the circuit, if it can only be brought under control.

Once the principles of the Super-regenerative Circuit are roughly grasped, the circuit may be divided into three parts—1, the regenerative; 2, the oscillatory; 3, the amplifier, and further technicalities may be temporarily disregarded.

The first difficulty is to learn the tuning points of the regenerative circuit. To overcome this difficulty, the coils of the oscillatory circuit were taken off their holders and the valve was shut off. A good receiving valve was placed in the holder in the regenerative circuit, the hard valve being discarded for the time being. The set then became a simple receiving set with audio-frequency amplification. Using the outside aerial, clipped on to the side of the loop which is carried on to the grid condenser of the first valve, but no earth connection, 600 meter signals came in with half the inductance cut in, and 50 per cent. of the condenser in series with the loop. The same signals came in equally well with all the inductance in, and 5 per cent. of the condenser. This furnished some-



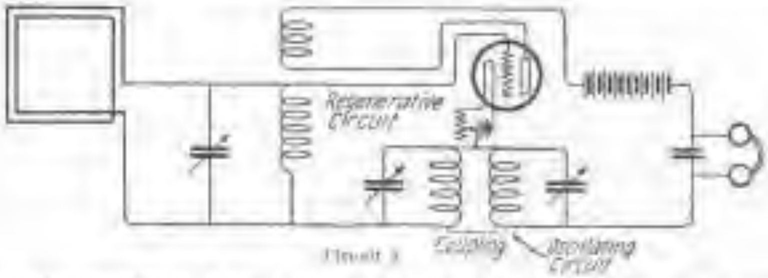
The Tuner Coupler specially designed for the Armstrong Super-Regenerative Circuit

Continued on Page 27

An Exhibition Receiver of Gold and Ivory

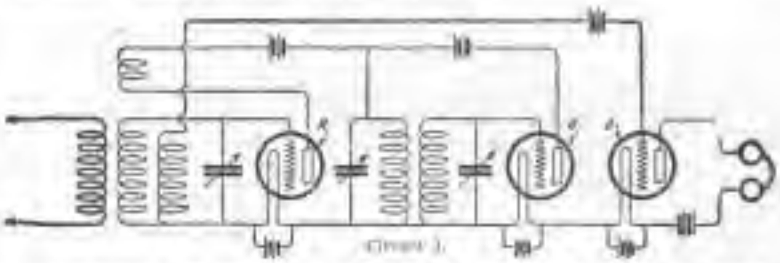
Wide World Photo; exclusive to the Australasian Wireless Review.

Here is the world's costliest radio set, made of ivory, and mounted in gold and said to have cost over £200. It was made by the Crosley Radio Co. for the Radio Exhibition recently held at Grand Central Palace, New York, U.S.A. It is a radio-audio frequency receiver, with a loud speaker included in the make up. A loop aerial set in the back of the receiver does away with the necessity for aerial and earth connections, the only external connections being those of the "A" battery. The happy young lady listening the broadcasted sounds is Miss Madge Kennedy, daughter of the senior partner of the firm. She is "tuning" the carrier wave prior to switching in the loud speaker.



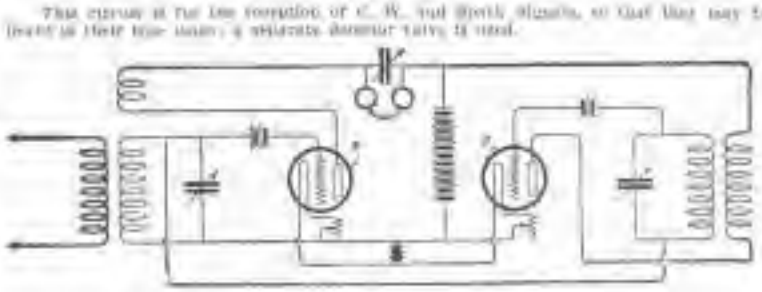
Circuit 3.

A circuit where one valve performs all functions, regeneration, amplification and rectification. Constants are similar to those in Circuit 1.



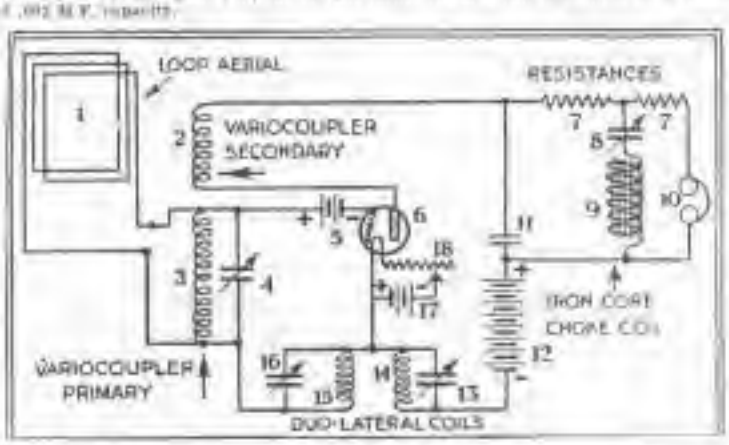
Circuit 2.

This circuit is for the reception of C. W. and Spark Signals, so that they may be heard in their true tones; a separate detector valve is used.



Circuit 1.

A circuit which has given excellent results in the reception of [illegible]. The constants are: — Secondary, a 75 turns honeycomb coil; tickler, one of 75 or 100 turns; condensers, .001 M.F.; grid battery, 6 volts; "B" battery, 140 volts; grid coil, a honeycomb of 1500 turns; plate coil, one of 1250 turns; the grid coil is shunted by a condenser of .001 M.F. capacity.



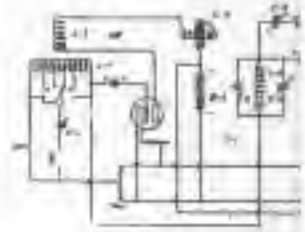
Circuit 11.

The above diagram shows the already famous Armstrong Super-regenerative system employing one vacuum tube only. In this circuit the constants are as follows:

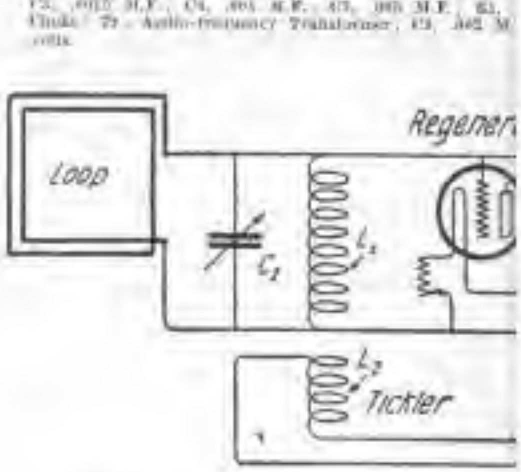
(1) Loop aerial, 12 turns on a 3-foot frame, wound spirally. (2) Secondary of the regulation variocoupler [illegible]. (3) Primary of variocoupler. (4) Variable condenser, .001 m.f.d. (5) The C battery, 4 volts maximum. (6) Vacuum tube. (7) Resistances, 12,000 ohms each. (8) Variable condenser, .001 mfd. (9) Iron core choke, 100 millihenries inductance. (10) Telephones. (11) Fixed condenser, .005 mfd. (12) B battery, 80 volts maximum. (13) Variable condenser, .005 mfd. (14) Duolateral coil, 1500 turns. (15) Duolateral coil, 1250 turns. (16) Variable condenser, .005 mfd. (17) Storage battery, 6 volts for [illegible] or [illegible] volts for [illegible]. (18) Standard filament rheostat.

Comparision of Armstrong Super[illegible]

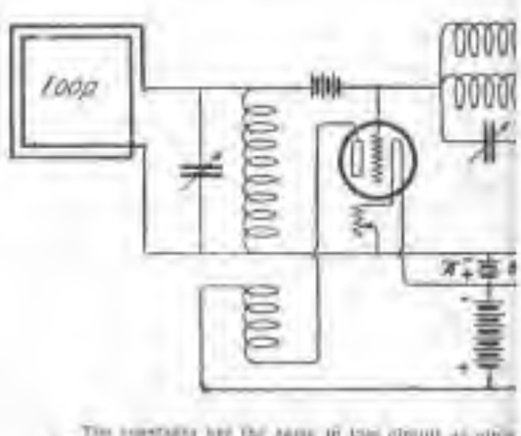
The Experimenter may construct the most efficient circuit by embodying the leading points of other circuits in his own



This diagram is that of the back of panel illustrat[illegible] variometer in series with the vario-coupler secondar[illegible] L3, the variometer; L4, honeycomb coil of 1500 turns [illegible] C2, .0005 M.F.; C4, .001 M.F.; C5, .005 M.F.; [illegible] Choke; T2, Audio-frequency Transformer; C3, .002 M[illegible] coils.



L1 and L2 are a variometer of special design [illegible] L3 and L4 are two honeycomb coils of 1500 turns [illegible] condenser of .001 M.F. capacity; C2 is a fixed condens[illegible] [illegible] valve.

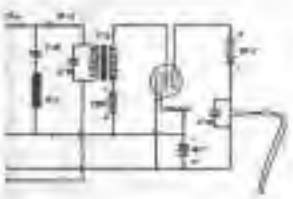


The constants are the same in this circuit as circu[illegible] [illegible] Henry Iron Core Choke and a .005 condenser, [illegible]

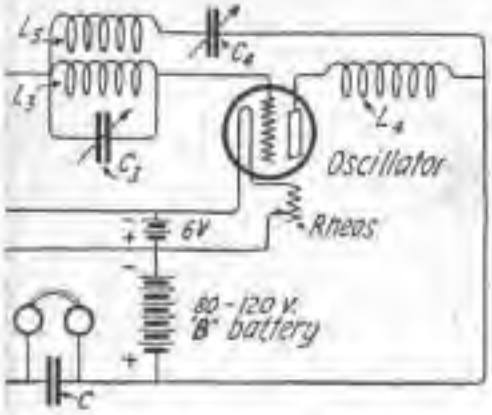
...ious Diagrams

...generative Circuit

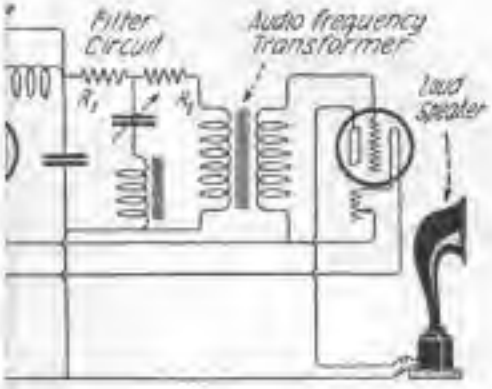
Many thousands of amateurs are engrossed in the fascination of the Armstrong Super-Regenerative Circuit



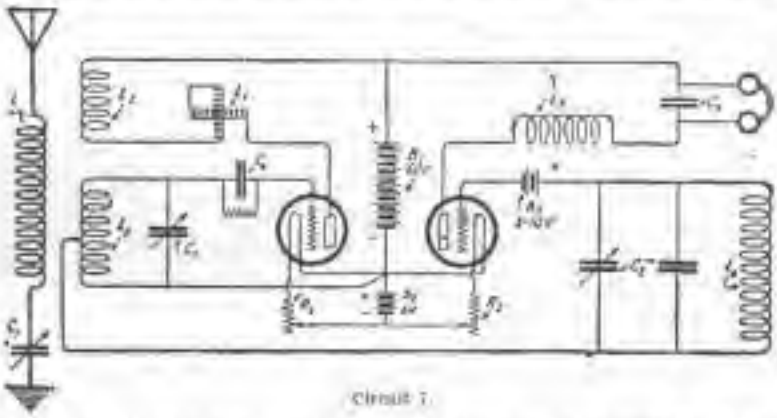
...switch. An ordinary vario-coupler is used, with a ...001 M.F. capacity; L3 and L2, the vario coupler; ...250 turns; L6, one of 300 turns; C2, .001 M.F.; ...resistance; C3, .005 M.F.; R1, .1 Henry Iron Core ...M.F.; Pot, 200-400 ohms; B1, 100 volts; B2, 200



...loop aerial has 12 turns each, 24 feet on the side; ...ballast coil of 300 turns; C1, C3 and C4 are variable ...001. The valves are either amplifying valves or

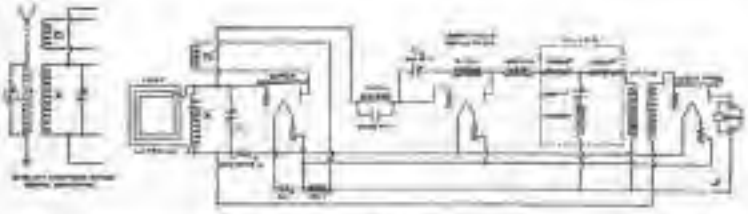


...addition of two resistances of 12,000 ohms each, a ...for circuit.



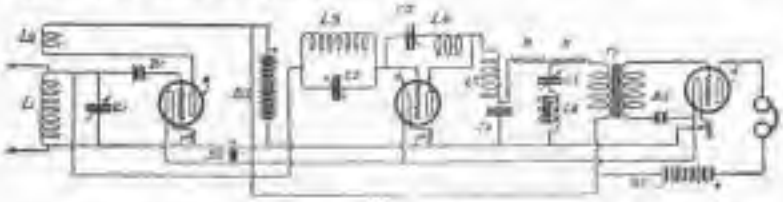
Circuit 7.

L, L1, L3, are a loose-coupler, L being the primary coil of 40 turns, No. 22 D.C.C. wire, the first ten turns tapped each turn, then nine of ten turns each. L1 is the secondary coil of 40 turns of the same gauge wire, tapped at eight groups of five turns each. L2 is the tickler coil of 35 turns of the same wire, and is wound on the same tube as the secondary and adjacent to it. L3 is a standard variometer, with the rotor terminal connected to the plate of the valve. L4 is a honeycomb coil of 1500 turns, shunted with two condensers C5, capacity .0025, made up of a .002 fixed and a .0005 variable. L5 is a coil of 1250 turns. C1 is .0002 variable; C2, a .0005 variable; C3, a fixed .001; C4, is a .0005, M.F. grid leak condenser. Vernier rheostats are used.



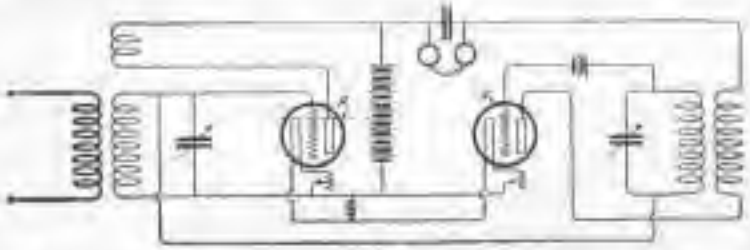
Circuit 8.

A circuit which may be [illegible] a loop or outside aerial. The constants are given on the diagram. When using honeycomb coils, the same coils are used as in an ordinary circuit. The air core choke is a honeycomb coil of 400 turns. The oscillatory circuit coils are the usual 1500 and 1250 turns honeycomb coils. With 120 volts "B" battery, a "C" battery of 9 volts is used.



Circuit 10.

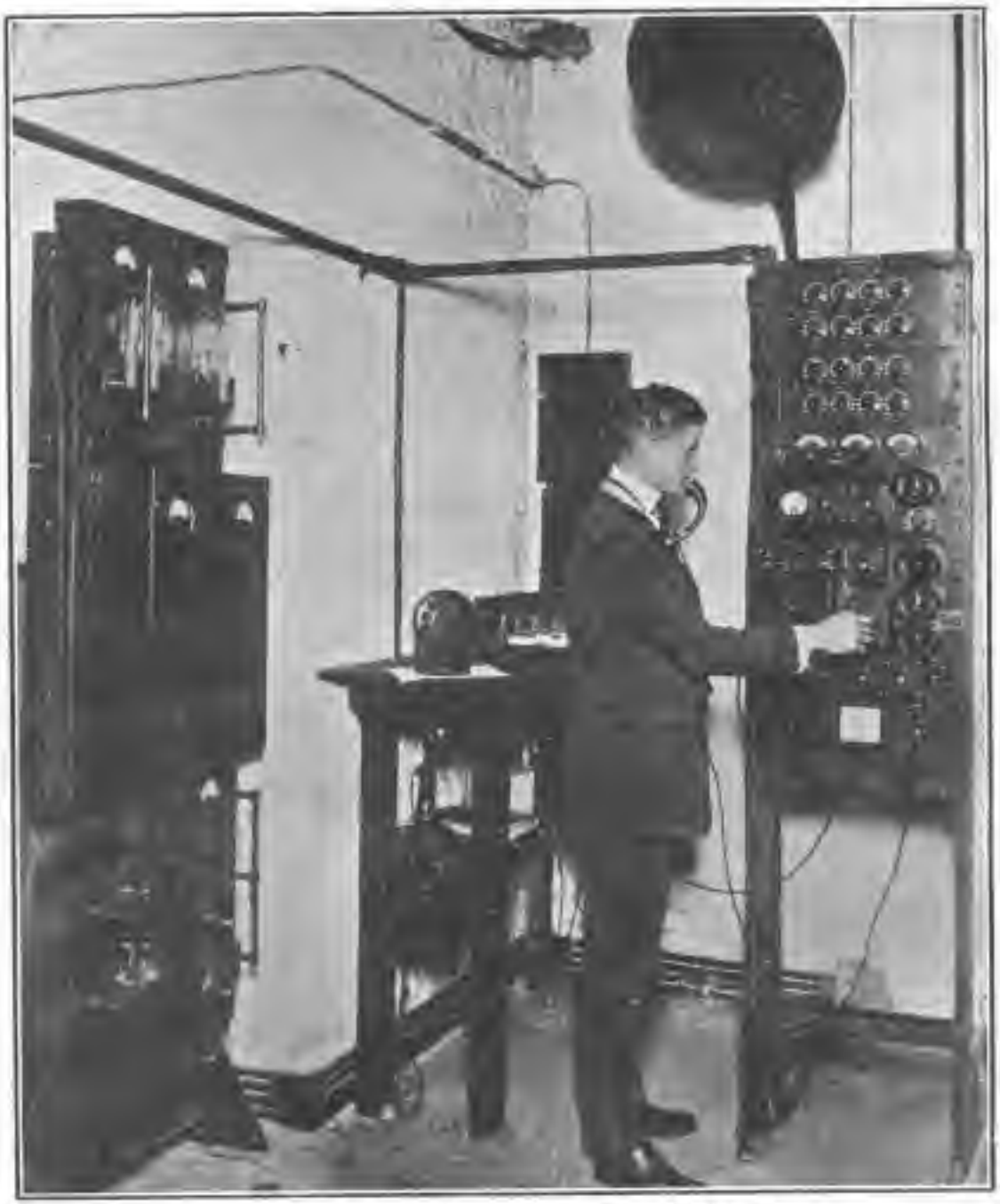
The circuit used by Major Armstrong in his super-regenerative receiver as demonstrated before the Radio Club of America. The Constants are as follows: L1, L2, variocouples; C1, .001 M.F.; R1, 5 to 7 volts; R2, 4 volts; R3, 90 volts; L3, 1250 D.C.C.; C2, .0025 M.F.; L4, 3 millihenries; L5, 1500 D.C.C.; C3, .001 M.F.; C4, .005 M.F.; C5, .005 M.F.; R.R., 12,000 ohms each; L6, 1 Henry; Tr., audio frequency amplifying transformer; R4, 2½ volts; R5, 200 volts.



Circuit 9.

Same constants as in circuit 7. This is also an excellent circuit for the reception of telephony.

Wireless at the Capitol, Washington, U.S.A.



Wide World Photos, exclusive to the Australasian Wireless Review.

The need for radio is here depicted. The illustration shows the installation for amplifying and transmitting the speeches of Members of the United States Federal Parliament, at the Capitol, Washington. The set is powerful enough to reach to the confines of the States, North, South, East and West. Listeners in can hear what their member is saying on any Bill or motion before the House, and in this way members and their constituents are brought into closer touch, a greater interest is taken in public affairs, with the result that a more intellectual citizenship is being built up of which America will some day be justly proud.

Continued from page 27

tking of an idea as to the tuning points.

The oscillatory circuit coils were then replaced and the valve switched on. The hard valve was put back in the regenerative circuit.

Leaving the outside aerial clipped to the loop and with the inductance set for 600 meters, signals came in like the bark of a big Newfoundland dog. The correct "listening in" point was found to be with the rotor of the variometer turned to just this edge of the roar.

The condenser C, attached to coil A, was at 70 per cent., and turning this in further, and right to maximum, the signal strength was increased, but the roar increased, too.

A potentiometer, the slider of which was attached to a "C" battery of 22½ volts in 1½ volt steps, as shown in Figure 3, March "Review," with the negative side of the battery taken to the loop and condenser connection as in the diagram mentioned, was instrumental in considerably clearing the roar trouble. The best point found for the "C" battery as far as about seven volts, but concert came in reasonably clearly on the full voltage.

With all the inductance in, and with a 75 turn honeycomb coil in series with it for loading purposes, Garden Island (Sydney) concert was brought in very loudly on the loop on 1500 meters, but, of course, with much less volume than may be expected with further adjustment, that is, if the system is capable of anything like maximum amplification on such a wave length.

In operating the circuit there is an order of procedure which should be always followed. All three valves are switched on, and the first effect should be to set up the high-pitched whistle, which shows that the oscillatory circuit valve is oscillating. If this is not heard, vary the condenser in the oscillatory circuit. If there is no response, vary the plate and grid batteries of the oscillatory valve. If the whistle is still unheard, something is wrong with the connections. When the whistle shows that the oscillatory circuit valve is oscillating, the valve in the regenerative circuit must be made to oscillate. This is done by varying the condenser in the loop circuit, and by adjusting the variometer. The roar in the 'phones or loud speaker indicates that the regenerative valve is oscillating.

When the two valves are oscillating, the movement of any of the variable elements should produce a series of heterodynes of harmonics. Unless these are heard there is something wrong, and no progress can be made. Those who have not obtained these effects should realise that their circuit is not functioning properly. If the circuit is wired up according to Fig. 1 or Fig. 2 (minus the filter), March "Review," no difficulty will be experienced in obtaining the heterodyning of harmonics sounds. The writer obtained them the first time the circuit was put into operation.

Tuning the regenerative circuit is easy once an idea of the tuning points has been gained, in the manner described. The tap of the inductance is set, then the regenerative circuit condenser is varied, and finally the variometer is adjusted. Turning the condenser or condensers in the oscillatory circuit increases the amplification, but also increases the roar. Varying the potentiometer and "C" batteries will reduce the roar materially.

Major Armstrong used the filter in the circuit when giving his demonstrations, and the object of the filter is to prevent the intermediate frequency of the oscillatory circuit from paralysing the audio-frequency amplifying valve. It would seem that this filter is necessary if the one-stage amplifier is added. Obviously, the filter circuit is not required when operating a Super-regenerative circuit having only two valves.

Back of Panel View of the circuit employing an ordinary Vario-Coupler and an ordinary Variometer in series

Although the many circuits and their accompanying instructions which have come to hand seem very confusing, there is not much difference in the leading features—the differences are in the minor matters only.

All the circuits employ the 1500 and 1250 turn coils in the oscillatory circuit.

An ordinary vario-coupler may be used as the inductance: if the secondary is re-wound with 50 to 100 turns of finer wire in one layer. If the secondary is not so re-wound, a variometer placed in series with it seems to serve equally well. In one circuit the oscillatory condenser is placed in series between the choke coil and coil A. In another one, coil A is shunted by one condenser, and another one, of .001 M.F. capacity, is placed in series with the honeycomb coil acting as an air choke, and the shunted A coil.

In the different circuits, the air core choke coil varies. In one it is a honeycomb coil of 200 turns; in another, 200; and in still another, one of 400 turns.

In some circuits, the oscillatory coils are placed in inductive relationship, in others not. A view of Major Armstrong's demonstration set shows the oscillatory coils inductively coupled to the vario-coupler and variometer.

One of the features of the Super-regenerative Circuit is that one circuit may be arranged for the reception of C.W. and spark signals in their true tones, and another one for the reception of telephony only. The latter circuit, therefore, ensures immunity from interference by spark stations in concert reception.

One of the illustrations shows the back of a super-regenerative panel, where an ordinary vario-coupler is used as the inductance and a variometer is placed in series with the secondary of the vario-coupler.

The illustration of the special vario-coupler gives the necessary information for construction, and shows how it is coupled into the circuit.

A number of circuits are furnished for the purposes of comparison.

The Structional Differences of Radio Valves

THE only structural differences between types of modern valves are those differentiating power or transmitting valves from low power receiving valves. The transmitting valves have larger elements in proportion to the amount of energy they control, with different spacing suited to the requirements of insulation, and a higher vacuum.

In low capacity receiving valves (capacity in the condenser sense), which include practically all the present day valves used for detection and amplification, the structural details may be identical, whether used for radio or audio-frequency amplification. However, until a few years ago, when valve construction became a more exact science, all valves possessed a comparatively high capacity, due principally to the design and placing of the elements and leads. As the valves were imperfectly evacuated, it is possible that the presence of air or gas, with the corresponding dielectric constant, may have increased this capacity.

Due to this condenser effect, pre-war valves could not be used for radio frequency transformer amplification on short waves. The capacity of a valve is virtually shunted across the primary of the amplifying transformer, which, if the transformer is of the radio frequency type, will boost the wave, as will any condenser across an inductance. Thus, on short waves, where the addition of even small capacities has a comparatively large effect on wavelength, radio-frequency amplification was very inefficient, for little transference of energy could be effected on the few turns of wire to which the resonant transformer was limited.

As mentioned above, there is today no structural difference between radio-frequency and audio-frequency amplifying valves. However, detector valves have a lower vacuum than those designed for amplification.

Several effects combine to make the low-vacuum valve more sensitive to weak grid impulses, and they are therefore more efficient in the original detection of signals. However, in succeeding steps of amplification, the impulses become stronger and stronger, and are capable of controlling a more powerful stream of electrons, or plate current, than was possible before, due to the inertia of the electron. (Inertia is a quality possessed by everything having mass, which resists any attempt to vary its relative state of motion.) The idea will be made more clear by analogy. It is an easy matter for a ball player to catch a baseball travelling fifty feet a second, but it would require a giant (no pun intended), comparable to a larger grid impulse, to control or stop a cannon ball moving at the same velocity! Thus a higher plate potential, which in part determines the strength of the electron flow, may be applied to the plates of successive steps of amplification, with a correspondingly greater response in the receivers or loud speaker.

Working back to the differentiation between detector and amplifying valves, it is necessary to evacuate the valve more completely when a heavier current is to be passed through it, owing to the fact that the partly gaseous content of a low-vacuum valve would be ionized by the electron stream. Ionization is the breaking up of the atoms of gas into their component positive and negative charges, a condition which is indicated by a blue or purple haze surrounding the elements of the valve, and which greatly affects the negative charges, electrons, given off by the filament, generally rendering the valve inoperative.

A very interesting example of ionization in a partial vacuum is the northern lights or Aurora Borealis. This phenomenon is caused by the passage of electrons, thrown off by the sun, through the rarified upper strata of the polar atmosphere, where they are apparently concentrated by the earth's magnetism.

A Transmitting Set with a Record

THE C.W. signals of an American amateur have been heard at a distance of 6000 miles from the sending station, only 20 watts power being used, a remarkable performance when it is remembered that 20 watts represents but 40 per cent. of the power consumed in an ordinary electric light.

With the same set, the voice, with an aerial current of 1 ampere, has been heard over great distances.

The aerial consists of six parallel wires spaced 4 feet apart, and are 65 feet long. The height of the aerial is 45 feet.

This aerial system has a low natural period, and also low resistance, operating most efficiently at approximately 200 metres.

The panels are made of ¼-inch insulating material. The front panel is 14 inches by 18 inches, the main shelf 10 inches by 14 inches, and the sub-shelf is 4 inches by 14 inches.

Mounted on the main panel is the aerial meter, in the centre, at the top. Peep holes are drilled for each valve, and the shelf carrying the valves is 10 inches from the top of the panel to allow the valves to be seen at the correct height. The rheostats are mounted under each peep-hole. The change-over switch is mounted in the middle of the panel, just below the line of the rheostats. The filament transformer switch is on the left, below the change-over switch, and the motor generator switch is on the right.

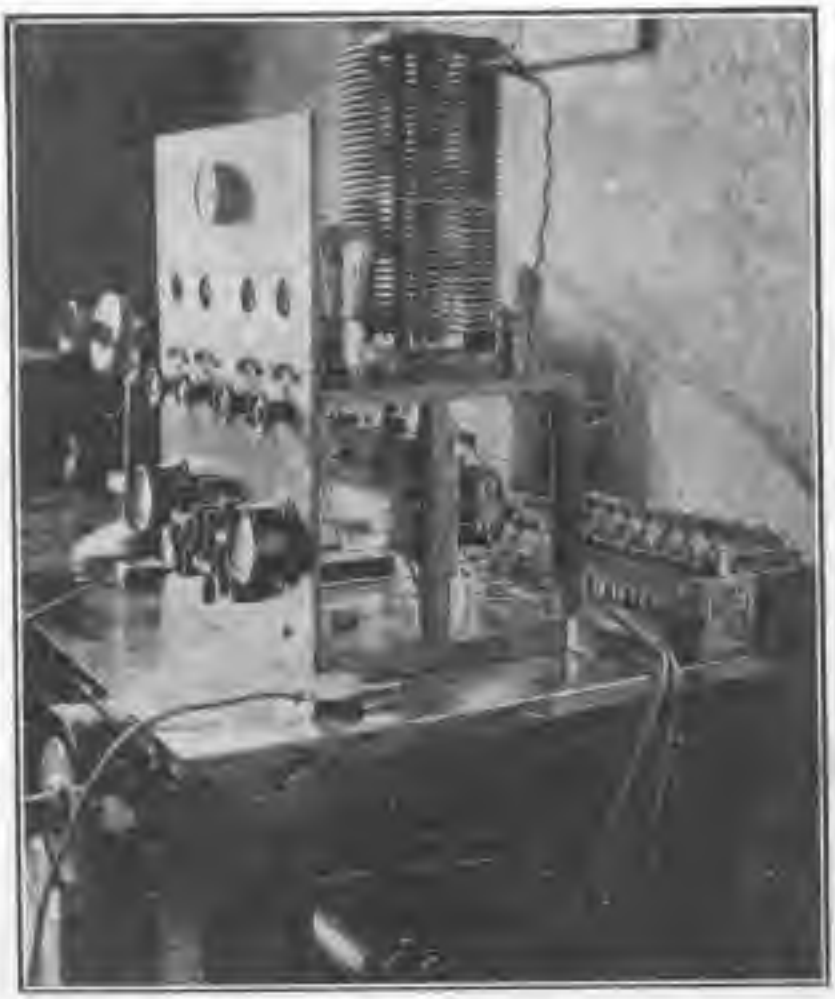
A 0-50 M.A. meter is on the left lower corner, and another one, ranging from zero to 250 M.A., is on the right lower corner.

The first one (full scale deflection 50 milliamperes) registers the grid current, and the other the total plate current (full scale deflection 250 milliamperes).

Three jacks and two plugs are used.

With this arrangement the use of only one telegraph key is necessary. One of the plugs is connected to the key, which, when plugged into the upper jack on the lower left-hand side of the panel, will make and break the 6 volt circuit to the buzzer, and when plugged into the right-hand jack on the panel will make and break the grid leak circuit for continuous wave transmission. The other jack is connected to the modulation transformer. The microphone is connected to another plug, which is inserted in the lower left-hand jack.

On the main shelf are mounted four valve sockets, the inductance coil and the buzzer. The inductance



General view of the 5w transmitter.

is 7 inches in diameter and 9½ inches high; it is wound with bare copper wire of No. 10 gauge, 35 turns, ½ inch apart. The wire is wound into grooves cut into the insulating material uprights and fastened securely at both ends. The leads are attached with the usual spring clips.

On the small sub-panel placed underneath, and parallel with, the main panel, and mounted on another set of brackets, are the modulation transformer, grid condenser, grid leak, plate condenser, audio-frequency choke coil, and two radio-frequency choke coils.

The grid condenser is made up of seven pieces of copper foil .002 inch by 1½ inch by 2½ inches, with thin mica as dielectric, pressed and immersed in boiling paraffin wax. The grid leak is of 3000 to 5000 ohms resistance. The plate condenser is a .25 mfd capacity condenser, but any condenser which will stand the plate voltage is suitable, and a duplicate of the grid condenser would do quite well. This condenser prevents a short on the

generator in case the aerial should accidentally become earthed.

The audio-frequency choke coil is of 3000 turns of No. 36 d.s.c. wire wound on a square insulating tube that fits neatly on the centre leg of iron punchings. The punchings are 4 inches long by 3 inches wide, outside measurements. The wooden spools on which the radio-frequency coils are wound are 2 inches diameter by 1½ inch deep. The centre of the wooden spools is ¼ inch in diameter. They may be of cigar box wood well varnished with shellac.

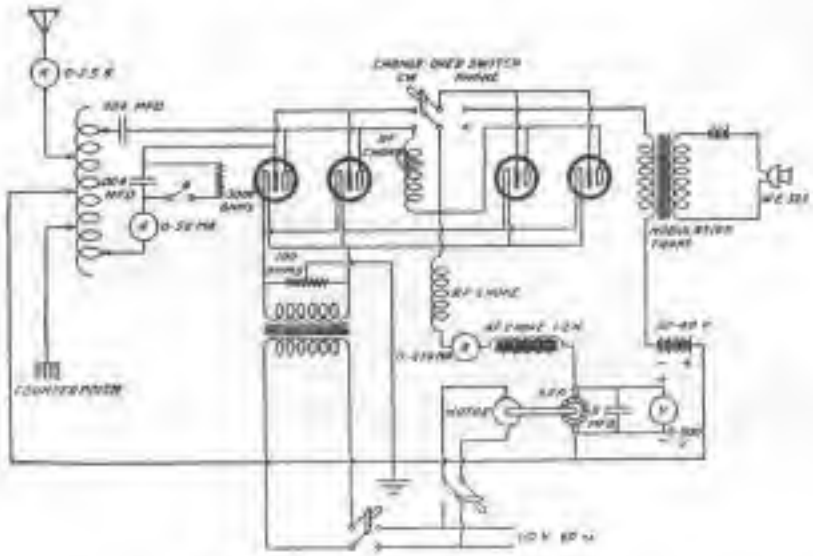
These spools should be wound full of No. 30 d.s.c. wire.

Across the back of the wooden uprights which support the main panel a strip of insulating material, 1 inch by 14 inches, is bolted, on which are arranged the necessary terminals for the filament, plate, grid, buzzer, and microphone current supply.

A motor-generator is used for the plate current supply, delivering 750 watts at 400 volts. The filament supply is obtained by stepping down the a.c. line current to 7 to 8 volts by means of a transformer. Across the secondary of this transformer is a 100 ohm resistance, centre tapped to obtain the same effect as actually centre tapping the winding of the transformer.

A 1000 volt .5 mfd condenser should be placed across the generator or plate supply, and one radio-frequency choke coil connected in series with the generator. This forms an efficient filter for doing away with the commutator ripple.

No. 14 bare copper wire is used for connecting up the set in accordance with the diagram herewith.



Wiring Diagram of the Transmitting Set.

With proper care in wiring, and provided that the aerial system is suitable, the aerial current should be 2.5 amperes, using four valves as oscillators on 200 metres.

For transmitting the voice, two valves should be used as oscillators and two valves as modulators. The aerial current should be 1 ampere or more.

In the wiring of the set, as shown in the diagram, Heising modulation is used for voice transmission. A switch is provided for using all four valves as oscillators for C.W. telegraphy—in which case the telegraph key in the grid circuit is used for sending code.

The photo. of the assembled set will convey an idea of the general make-up.

Making an Earth

IF you are unable to connect your earth lead to any house piping, a good "earth" can be made in the following manner.

For amateurs who instal their apparatus in a shed at the end of a garden, this alternative earthing system will prove useful:

Procure a fairly large piece of sheet copper. Don't let it be less than eighteen inches square; let it be larger if possible.

Choose a suitable spot in your back garden where the ground is most frequently inclined to be wet, and dig a hole there about three or four feet deep.

Be sure that the spot chosen is likely to retain its dampness, even during long dry spells. If there is any doubt as to this, it is a good plan to dump a bag of charcoal into the hole.

Charcoal holds moisture very well, and if it is packed carefully about your copper plate, will safeguard you against your set being put out of action by lack of dampness at the crucial spot.

Having packed the charcoal suitably, pour a pail or two of water over it, then fill in the hole, packing the earth tightly back into its place.

Be sure that you have a good strong copper wire securely soldered to the plate before filling in, and take care not to pack the earth so tightly as to break away the soldering.

By the way, copper tubing, such as is used in motor cars, is even better than the above-mentioned strong copper wire.

Then connect with your receiving set, and you are ready for the next message that comes along.

How to Begin: By an Amateur for Amateurs

Article 3

HAVING procured everything necessary to complete a crystal type of receiver, I had to consider the matter of erecting an aerial and making the earth connection. First of all, I had to decide which kind of aerial would suit my purpose, as I learned that there are almost as many kinds of aerials as there are inductances.

My bump of inquiry prompted me to buy a little book with a nice picture on the cover, entitled "Aerials and How to Erect Them." The illustrations showed aerials with one wire, two, three, four, and up to seven wires, and one picture had a fearful and wonderful looking arrangement which had a single mast with a sort of cross at the top, with four aerials of four wires each suspended from it and carried down towards the ground at an angle of about 30 degrees. There was a small forest of wires from the top of the mast also, seemingly bunched together at the bottom, and marked "lead in." This was described as an aerial of the "umbrella" type.

I decided **not** to have an aerial of the umbrella type.

Somehow I did not fancy the single wire aerial—it looked too amateurish, I thought.

Strolling round amongst the shipping, I paid special attention to the aerials on the ships. I noticed that practically all of them had just two wires spread about six to eight feet apart on what appeared to be slats of wood. I fixed on an aerial of two wires. This kind, I found, was termed a "twin wire" aerial.

My little book informed me that twin wire aerials could be either of the "T" type, or of the inverted "L" variety. I had noticed that on many of the ships the lead in wires were taken from somewhere more or less near the middle of the aerial to the operator's room. I decided on the "T" type, and planned to take my lead in wires from just above the window of the upstairs room where I proposed to work my "set."

A visit to the radio dealer put me in possession of the knowledge that a stranded wire was better for an aerial than a solid wire, owing to "skin effect." It was explained to me that the electrical current employed in wireless telegraphy did not penetrate a solid wire, but travelled on the "skin" of it, therefore the more "skin" the more powerful the wave received, hence the use of several wires twisted together, called stranded wire.

It seemed that seven wires of 22 gauge twisted together were exceptionally good for aerial wires, but three similar wires twisted into one formed a wire good enough for all practical purposes. I ascertained that the same kind of wire would suit admirably for the earth connection.

The greatest length I could run my aerial was about seventy-five feet, so I judged that I had better get 300 feet of the 7/22 wire, as it is called, to allow for the lead in wires and the earth connection. Reference to my book again showed me that the aerial wires must be very efficiently insulated from the possibility of the aerial current finding its way to earth, which it would prefer to do rather than encounter the difficulties of getting through an inductance and, possibly, a condenser. I accordingly procured six large porcelain insulators, two at each end to attach the wires to the spreader, and one for each end to insulate the wire straining cable from the rope loop which holds the spreaders in position.

I next visited the ship chandler's, where I bought about 30 feet of hempen rope three-quarters of an inch in **circumference**, fifty feet of stranded wire cable, a ball of marlin, and a pulley block of galvanised iron about 2½ inches long.

Apparently the only problem I had yet to solve in connection with the aerial was the matter of spreaders. I had read somewhere that bamboo poles made both good masts and spreaders for aerials, having the combined advantages of lightness, strength and cheapness. After rummaging through several furniture manufacturing establishments, I managed to get hold of two bamboo curtain poles, six feet long, and two inches in **diameter** (not circumference).

To erect the aerial I could make use of a chimney at one end, the top of which was about fifty feet from the ground. A tree at the other end had a convenient fork about forty feet up that would carry the straining cable. The building was of brick, and I had to put on my considering cap to reason out how I should attach the spreader of the aerial to the chimney. As the result of the reasoning process I bought a few feet of No. 8 fencing wire to form the anchorage of that end of the aerial.

My job now was to make up the aerial itself. It seemed a very simple matter until I started, but I soon found that it was not so simple as it looked.

I started by measuring off 77 feet of the three strand wire, then I doubled this length back on my 300 feet coil, and had my two lengths of wire for the aerial proper, of 75 feet each, plus one foot at each end to twist round the insulators and to twist on itself for soldering. I took two turns round each insulator, then coiled the remainder of the free end in a close coil round the aerial wire, and completed the job by soldering over the inch or so of the twisted wire, using a blow-pipe, with Fluxite as the flux.

I then carefully cleaned off all traces of the Fluxite, and finished the joint by wiping it with an oily rag. The next step was to attach the insulators to the spreaders. This I proposed to do

with the rope I had bought. Not being a sailor, or even a handy man, I only knew one kind of knot for rope, that called a "stage" knot (used in manipulating scenery) the kind the grocer uses when he ties up a parcel—a slip knot with another knot added to prevent the slip knot slipping. A double knot of this description served to secure the insulators to the spreaders, a twist being given to the rope so that the tie formed a figure 8, and the middle was served with marlin to retain the double knot loop in position. The rope loop on each insulator was fixed on the extreme end of the spreader, and secured in place by taking several turns round the bamboo pole with marlin and crossing the knots several times with the same medium. Two eight feet lengths of the rope were now cut off to attach the spreaders to the anchor at one end, and to the straining cable at the other end. A stage knot was put on on each end of the short pieces of rope, and each knot was pulled tight on the bamboo pole, inside of and as close as possible to the insulators.

Before tying the knots, an insulator was threaded on to each short length of rope. The exact centre of the rope was found, and then a loop was made to hold the insulator in the centre position by binding the rope on each side of the insulator with about a dozen turns of marlin.

Guessing the position where the lead in wires should come (here were twisted round the aerial wires and soldered, and I was then ready to have the aerial raised into position.

The No. 8 fencing wire was now passed round the chimney stack and twisted tight. To this was secured one of the spreaders, the fencing wire being passed through the hole in the centre of the insulator for this purpose. The wire cable was passed through the pulley block, well up the tree, and the free end of the cable was thrown through the fork of the tree already mentioned. The end of the cable was passed through the eye-hole of the second spreader insulator and firmly twisted to secure it there.

Hauling on the wire cable, threaded through the pulley block, speedily raised the remaining spreader into position, and the trials and tribulations of aerial making and erecting were at an end.

I have omitted to mention that to each end of each spreader I attached a 60 feet length of the marlin to act as a guy, to enable me to "trim" the aerial to the horizontal position and to keep it there. I have found this very useful, and it is a tip well worth noting.

When the aerial had been in use a little time, I found that I was under certain disabilities in having an aerial of an uneven "T" type. What I mean by an uneven "T" type is that I did not have the lead in wires exactly in the centre of the aerial wires, but placed them where they would be most convenient to the window of my wireless room. A friend advised me to convert the aerial to the inverted "L" type. This I did, and the results have been much more satisfactory.

Just a word or so about the way I brought in my lead in wires. I carefully measured the width of the window sash in the grooves where the upper sash slides up and down. I then cut a piece of one-inch pine the exact width of the sash, and my measurements had been so accurate that the piece of wood had to be hammered into position at the top of the sash. Before fitting in the piece of wood I cut a piece out of the top of it 1½ inch wide by 1 inch deep. As I hammered the wood into position, I placed the porcelain lead in tube in the slot described, and continuing to gently tap up the wood, the tube was soon firmly held in its place by the wood on the under side, and the sash on the upper side.

By the way, "marlin" is a tarry string used in rigging ships, and is about 3/32nd of an inch in diameter.

There remained the fixing of the earth wire.

About twenty feet of the 3/32 stranded wire was run by the most direct course to the nearest water tap. About an inch of the galvanised water piping was scraped perfectly clean and bright, and several turns of the wire were twisted round it. A very hot soldering iron, some good solder, and a touch of Fluxite secured the wire to the water pipe. Although there was water in the pipe, the very hot iron created enough "skin" heat to allow the solder to adhere to it.

I have gone to some length in describing my experience in providing the aerial and earth connections of my receiving set, but as I am writing as an amateur for other amateurs, I have deemed it best to give the fullest possible details of my experiences in constructing and erecting an aerial and making the earth connection.

In most of the books, an elaborate wrought iron affair is shown in the pictures of aerial attached to chimneys. I avoided both the cost of having an anchor collar made for the chimney, and the unsightliness of such a contraption, by using the fencing wire, which is invisible at the height of fifty feet.

To make a stage knot, probably the best kind of knot for the purpose of making up an aerial, a single knot is formed, say, about eighteen inches from the end of the rope, which will then have a small loop in it. The little tail of the first knot is formed into a second knot, which is pulled tight. There is still a little tail projecting, and this is firmly lashed to the rope. This arrangement provides the means for pulling the loop tight on the spreader, and the second, or keeper knot, with the lashed tail, absolutely prevents such a knot from slipping. Scene shifters invariably use this kind of knot, as the harder the strain on the rope the more firmly the knot holds, whilst releasing the strain permits it to be easily removed.

(To be continued.)

The Latest Thing in Receivers

A THREE-VALVE receiver, based on a very novel theory, has been developed by an American doctor and scientist, who has devoted many years of his life to the study of high frequency currents and X-ray work.

Dr. Francis Le Roy Satterlee is the inventor, and he maintains that radio waves and light waves are much alike, although light waves are of a much higher frequency and shorter wave length than those employed in wireless. The doctor claims that radio waves may be reflected and refracted, or bent, by suitable instruments, just as light waves may be reflected or refracted by mirrors, prisms and lenses. He has devised a method for directing the waves within a receiver in order that they may be properly focussed upon the coil used in the secondary circuit.

Two primary coils are used, of the spider web type, and these primary coils may be varied as to their relative position to the secondary coil, in the same manner that the primary and tickler coils of a honeycomb inductance may be varied. Then comes the radical departure from accepted practice—the secondary coil, always a fixed coil in a honeycomb inductance system, may be moved up and down by means of a vertical slot in the ebonite panel of the receiver, in order that the proper "focussing" of the radio waves may be done. A glance at the accompanying illustration will convey an idea as to how the focussing is accomplished.

Those who have dabbled in the photographic art, and know something of lenses and of the conjugate foci of a lens, or of the glass condenser used in enlarging or lantern work, will readily conceive the possibility of a flat inductance, such as a spider web coil, having conjugate focussing points also. Referring to the photo., if we imagine the inner side of the two primary coils to be two mirrors, slightly concave, and the secondary coil a double-sided mirror with parallel surfaces, it is easy to conceive that each primary coil in turn may be varied in such a way as to throw a beam of light upon the secondary coil.

If the beam were not properly focussed, it might be of greater diameter at the point where it was intercepted by secondary mirror than the mirror itself. In that case a considerable portion of the light would pass off into space, and be lost so far as the receiver was concerned. On the other hand, the beam might be focussed in such a way that, when it was intercepted by the secondary, its diameter was considerably less than that of the secondary. In this case a large portion of the secondary would be inoperative, resulting in a loss of efficiency which might be obviated by correct focussing.

It may be that the radio waves

Back view of the Panel, illustrating the coils in action

energising the primary coils can be focussed upon the secondary coil in a similar manner. The vertical slot in the panel, which permits the secondary to be varied in relation to the primaries, is the essential part of the invention, as it is possible that it permits the moving of the secondary to the exact spot where the refracted radio waves from the primaries are focussed upon the secondary, so as to utilise to a nicety the full diameter of the secondary winding, and without allowing any portion of the radio beam to get past it.

If that is the explanation of the action of Dr. Satterlee's receiver, it is easy to understand its wonderful edficiency.

The inventor admits that certain of the principles of the operation of the receiver are not known to him, and a number of radio engineers who have seen it have offered various theories.

Major-General George O. Squier, of "wired wireless" fame, set aside fifteen minutes of his valuable time to examine the invention, and stayed some hours examining and adjusting it, and came away enthusiastic regarding the strength of the signals received and the unusually clear tone of the voice and music he had heard.

The receiver employs two stages of audio-frequency amplification, and with a loud speaker radio concerts are heard clearer than any gramophone renders a record. There is no howl, whistle, or scratching, no spark signals interfering, and no static.

The quality of the signals or music, etc., denotes when the "focussing" is exactly right, so that there is no difficulty in manipulating the receiver.

The wiring diagram shows that the circuit only differs from the ordinary circuit by including the two primary coils.

Two condensers are included, one of .001 M.F. capacity in the aerial circuit and one of either .001 or .0005 M.F. capacity in the secondary circuit.

Fig. 2.—Front view of the Panel, showing the Secondary Coil Slot.

As illustrated, the receiver is made up for the reception of short waves only, but there is no reason why spider web loading coils should not be employed for the reception of the longer wave lengths.

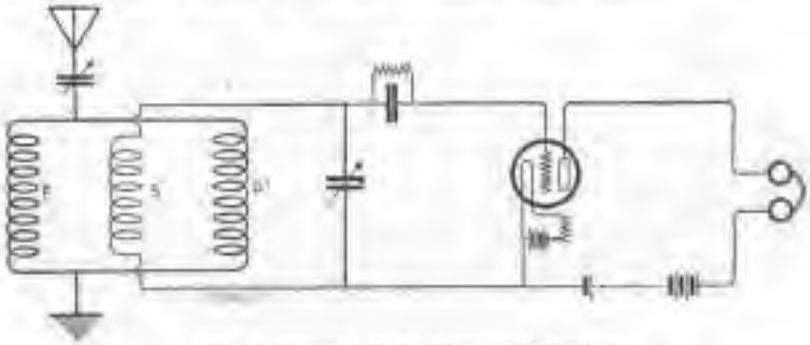


Fig. 1.—Diagram of Dr. Satterlee's Receiver.

In February and March "Reviews" full directions were given for making spider web coils, which are very easily constructed. With very little trouble keen experimenters can readily make up a receiver on the lines of Dr. Satterlee's invention to test it out.

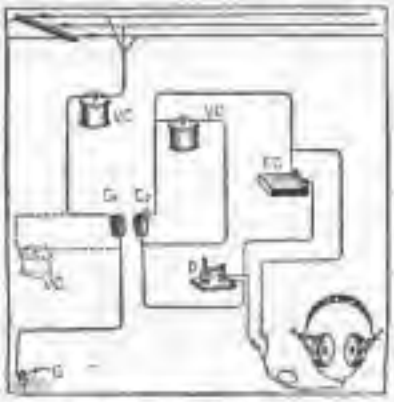
One of the largest electrical firms in the United States has taken the invention up, and it will be put upon the market shortly.

It is, of course, well known that until recently wireless conditions in the States were very chaotic. As an example, a sermon which was being broadcasted from a church in some smaller missions was deliberately jammed by an amateur

Tips for Fans

A CRYSTAL DETECTOR WITH HONEYCOMB COILS.

PROBABLY the simplest form of inductance to use with a Crystal Detector is a pair of Honeycomb Coils. The above illustration shows how they are coupled into the circuit. The two variable condensers and the fixed condenser across the phones are of .001 M.F. capacity. One .001 variable in the aerial circuit and a .0005 in the secondary circuit would serve. The condenser in the aerial circuit is shown in series with the aerial and primary coil. It may be attached in both wires leading from the Honeycomb Coil, as shown by the dotted lines, and it would then be in "shunt." It could also be placed between the coil and the earth connection, but it is usually more effi-



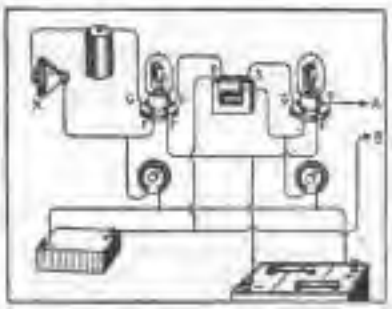
cient in the first position.

If two extra honeycomb coil holders are procured, to plug the coils into, the coils may be stood upright on a table and placed close together until the signal comes in, and then separated, until maximum results are obtained. The advantage of using honeycomb coils in this way is that the full range of wave lengths may be covered by placing in circuit coils of different sizes. A 75-turn coil in the primary and one of 100 turns in the secondary will bring in the 600 metre signals.

* * *

TO AMPLIFY PHONOGRAPH MUSIC.

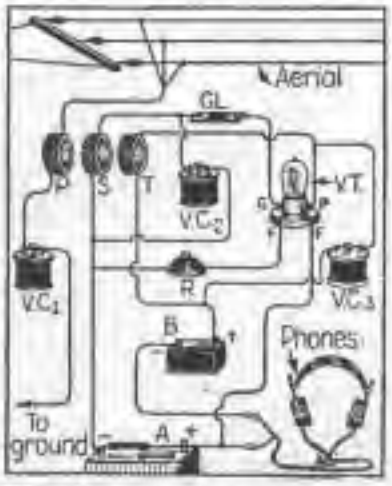
IT is often an advantage, for evening parties, to be able to amplify the music of a phonograph so that it may be used for the purposes of a dance. Here is the way to do it. A Skinderriken Station X is attached to the tone arm of the phonograph. A lead is taken from the button to the negative terminal of a dry cell,



and the positive terminal is connected to the grid of a valve, preferably of the amplifying variety. The other side of the button is connected to the filament lead. The plate of the valve is coupled to one terminal of the primary side of an ordinary audio-frequency transformer, and the other primary terminal is attached to the positive side of the "B" battery. One terminal of the secondary side of the transformer is taken to the grid of a second valve, and the other terminal is connected to the filament lead. A and B are leads from the plate and positive side of the "B" battery, and these are carried on to the loud speaker. The "B" battery is of 100 volts.

* * *

A REGENERATIVE VALVE RECEIVER WITH HONEYCOMB COILS.

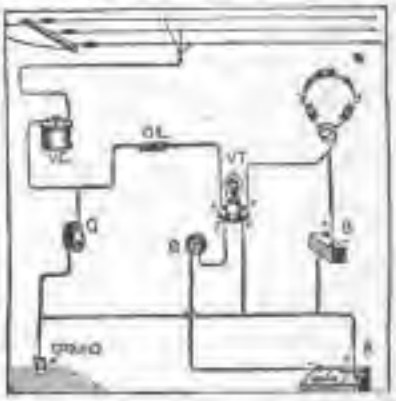


THE above circuit presents some features that are somewhat unusual. The condensers V.C. 1, 2, and 3 are .001 M.F. capacity, and V.C. 4 is shown in the ground or earth circuit. The secondary condenser, V. 2, is seen shunted round the secondary coil as usual, but the grid leak (G.L.) is interposed between the lead from the secondary coil and the condenser connection and the grid. In the plate circuit, V.C. 3 is shunted round the tickler coil "T," one side of the condenser being connected to the plate and the other to the positive side of the "B" battery. "A" is the "A" battery and "B" the "B" battery.

* * *

THE SIMPLEST FORM OF VALVE CIRCUIT.

THE simplest form of valve circuit is shown above, in which there is only one condenser, of .001 M.F.



capacity, one honeycomb coil, grid leak (G.L.), a "B" battery, and the "A" battery for the filament. The condenser serves the dual purpose of aerial tuning condenser and grid condenser. Two rather large terminals, screwed in a piece of wood and about an inch and a quarter apart, will hold a piece of slate pencil to form the grid leak. A pencil line, say, one-eighth of an inch wide, is run along the slate pencil right to the ends, so that the lead pencil mark will be well within the terminals. Rub the lead pencil well in so that a fair thickness of lead rests on the slate pencil, and you will have a grid leak of about 1 megohm resistance. Point the slate pencil at the ends to enter the holes in the terminals.

A honeycomb coil of 75 or 100 turns will be most useful.

How the Radio Valve Works

The Story of the Three-Electrode Vacuum Bulb told in a racy manner and illustrated in such a way that the Valve Action is made clear to the Veriest Tyro

YOU all remember what you learned at school about matter being made up of **molecules** and molecules being made of **atoms** beyond which matter is indivisible. That is, with a meat axe, you can divide a substance into small pieces like hash; and with a microscope and hair-splitting equipment you can divide a substance into pieces smaller than the naked eye can distinguish; after that by means of chemicals you can separate molecules from each other although you can't see them, even with a microscope; then with more chemicals you can separate the atoms from each other, but beyond this no treatment has any effect; at least, that's what we learned at school, and that effectually proves that there are no such things as fairies or daemons.

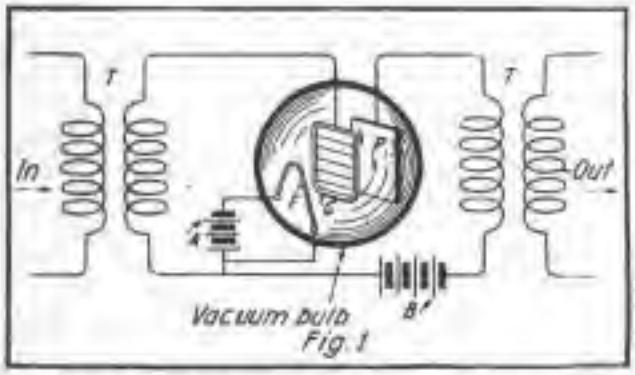


Fig. 1. View of valve showing how the filament, grid and plate are connected in the circuit.

But now come our highbrows with another story. Mind you, you don't have to believe it. They say that atoms may be made to **throw off particles** like a small boy throwing gravel at the passing trolley car, only the kiddies do it voluntarily for the fun of the thing, whereas the atoms must have some provocation; for example, if they get good and hot they commence to throw gravel like a terrier pup at a woodchuck hole.

Now, all ordinary people know how to take such talk as this. It's just the Arabian Nights and Dr. Cook stuff about stones talking and mountains splitting open, or the beautiful stripes around the North Pole. Nevertheless one of our cloister experts will draw you a picture like Fig. 1, to represent the interior of a vacuum bulb repeater, and says that "F" is a filament, which is heated red hot by the electric current from battery "A," and "P" is a plate which is connected to the outgoing line. In the space between the filament and the plate is the piece of picket fence "G," which is connected to the incoming line, and this gridiron is what puts the **fire** in amplifier.

To make the matter perfectly clear, as a fairy tale should be, look at Fig. 2, where instead of a filament there is an iron step-ladder on which you can see a lot of atoms, or daemons—it doesn't matter which you call them—and on the other side you see the plate as in Fig. 1. Between these two is an ordinary window blind with slats which are all operated together by the usual centre stick. Now, suppose a strong electric current is passed through the iron step-ladder so that it heats up like the filament in Fig. 1, then each little daemon gets as mad as a hen on a hot griddle, and begins to throw pebbles at the window shutter. What's that! Where do they get the pebbles! Say, this is a fairy story and you must not ask foolish questions. Lord Kelvin thought the atoms were made of these pebbles or corpuscles, and that these pebbles or corpuscles were, in fact, electricity itself, hence the name **electrons**. In other words, matter is made of electricity, and electricity is imponderable; therefore, there is no matter, and if there is no matter, it doesn't matter, and we should worry.

If while the daemons are bombarding the shutter we should open the slats, enough pebbles would go through and strike the plate to make a noise like a hailstorm on a tin roof, and the number that strike the plate would be in proportion to the amount the slats are opened. Therefore, if the slats are opened and closed in time with music it would be possible to play a tune on the plate, and if each **electron** carried a little bit of electricity with it, the effect would be like a current from the step-ladder to the plate, and this current would pulsate, increasing when the slats are opened and decreasing when they are closed.

This is just what happens in the vacuum repeater bulb shown in Fig. 1. The filament is heated red hot by the current from battery "A," and at this temperature millions of corpuscles or **electrons** are thrown off. The electric current is not necessary to cause this; the same thing would happen if it were heated by a gas flame. These electrons are considered to carry charges of **negative** electricity itself. Here again we should worry, because the result is the same, no matter what anyone thinks; because a current actually does flow from the filament to the plate.

You all remember that **unlike** polarities of electricity attract each other, while **like** polarities repel, and so if the gridiron is made negative to the filament the electrons will be repelled by it, and very few will get through between the slats; in fact, if the slats are too close together no electrons at all will get through to the plate. The effect

would be the same as though the slats in Fig. 2 were entirely closed.

It is generally known how the sound waves produce electrical pulsations in a telephone line; and you have only to imagine these pulsations of cur-

Imagine that the host of Daemons on the Lander (Filament) start throwing small pebbles (Electrons) through the Venetian Blind shutter, at the Target, the Plate. The band holding the opening and closing slats of the shutter, is something like the alternating current of the incoming signal. At one instant the pebbles are allowed to pass through freely, the next moment the shutter is wholly or partially closed.

rent coming to the induction coil "T" at the left side of Fig. 1. These pulsations are, of course, very weak because of the long line over which they have travelled, and the purpose of the repeater is to amplify or strengthen these pulsations.

Now, while it takes considerable power to open and close the slats of a window blind, especially if you painted them yourself last spring, the operation of the electric shutter is frictionless, and even the weak impulses of speech transmitted over 500 miles of line are sufficient to give the desired results, so that as each increase or decrease of current raises or lowers the negative potential of the grating "G," more or less electrons, each with its infinitesimal charge of electricity, get through from the red-hot filament to the plate, and give the exact same, but much stronger, impulses of current from the plate to the induction coil at the right side of the picture, and so out on the line for another 500 miles, the amount of additional **pep** put in the impulses depending on the strength of the battery "B."

Now you are probably wondering why this apparatus is put in a glass case. The reason is that the scheme will only work in a very good vacuum because a clear space is necessary for the electrons to travel in. You must remember that everything, even an invisible gas, is composed of atoms, so if there was air or any kind of gas in the space between the filament and the plate, the electrons would bump the atoms of the gas, while the daemons might put a good many across, the number would not be constant from minute to minute, depending on how successful they were in dodging the atoms, and the result of this would be a jerky current, which would entirely mask the telephonic pulsations. Therefore, in order to obtain the required accuracy of control of the rate at which the electrons strike the plate, it is necessary to pull out of the space between the filament and the plate every loose atom that it is physically possible to get hold of.

This is so important that our highbrows have developed an extremely interesting method of inducing daemons themselves to call the game when the space is cleared, but that is another story to be told when you have recovered from this one.

WORKING NOT A "FAG."

THE proprietors of State Express Cigarettes have installed on one of the floors of their factory a fully equipped "listening-in" installation of the most powerful nature. An experienced operator is in charge so that the workers may have a chance of hearing everything that is broadcasted during the day. In time, music and other features will be added, so that work will no longer be labour but pleasure.

The State Express Co. erected a wireless installation on their factory before the war, and endeavoured to get direct communication from factory to traveller, in order to expedite business and delivery. Unfortunately the interventions of the war prevented them carrying out this idea successfully.

"WIRED WIRELESS."

THE Marine and Small Craft Exhibition and Congress, held at the Agricultural Hall, was formally opened by the Duke of York, in what he described as a somewhat unusual way. He employed the method of speech transmission known as "wired wireless," in conjunction with the new loud-speaking invention embodied in the "Public Address System."

Speaking in ordinary conversational tones into a transmitter at Buckingham Palace, the Duke's voice was carried to the wireless stand directed by Autovoyors, Limited. Thence it was retransmitted by wire to the special loud speaker erected by this firm near the roof, through which it was heard distinctly in every part of the vast hall.

TRAVELLING NOW A REAL PLEASURE.

ARRANGEMENTS have been made whereby all the Union Steamship Co.'s vessels trading to Australia will receive the day's news by wireless every day the vessels are at sea. Wireless newspapers will be published each day on board, so that the morning paper will be as eagerly looked for at sea as it is on land. One of the disabilities of ocean travelling is being cut off from the world's news for comparatively long periods. This has now been overcome in connection with the Union Co.'s vessels trading between Sydney and Vancouver, Sydney and San Francisco, and Sydney and New Zealand. It is expected that the interstate vessels will be similarly supplied with the daily news in the near future.

The Electron

IN order that we may understand something of the way the valve works in radio circuits, it is necessary that we learn something of the nature of the electron.

All our conceptions of the external world are derived through impressions conveyed by the nerves corresponding to our five senses. These impressions are the result of vibratory forces which impinge on the nerve ends. Difference in sensation results from the varying rate of the vibrations and from the character of the medium through which the vibrant waves travel. For example. **Sound** is the result of mechanically excited waves transmitted through the air or some solid or liquid substance; at about 40,000 vibrations per second sound waves become inaudible, as our auditory keyboard has a limited number of notes.

We explain all natural phenomena by means of two fundamental conceptions called **Matter** and **Force**. Matter, we define as that which occupies space or takes up room. Force or Energy is that which produces a change in the form, nature, or position of matter. We assume that all forms of matter are composed of collections of extremely fine particles called Molecules. A Molecule is the smallest portion of matter that can exist alone. Under ordinary conditions these molecules, or infinitesimal particles of matter, do not touch each other, but are separated by relatively great spaces. This is due to the fact that molecules possess the inherent property of mutual repulsion, that is, each molecule tends to drive all other molecules as far away from itself as possible. The **mutual repulsion** of molecules is, however, more or less neutralised by the **attraction** which each molecule possesses for other molecules in its vicinity. These particles of matter are never at rest, but are constantly swinging through definite orbits; it is the inherent tendency to orbital motion which causes the molecules to apparently push each other apart.

Energy may be divided into **Mechanical** or **Molar force**, which produces changes in **masses** of matter; and **Molecular force**, which acts on the **molecules** of a mass. Heat is a form of molecular force which, when applied to a body, causes its molecules to swing through gradually increasing orbits, increasing the distance between each molecule and its immediate neighbours. This causes the **mass** of matter to **enlarge**, and consequently we say that a body "expands" when heated. When molecules are relatively close together, their mutual attraction is very strong, and the mass of matter would appear to us as being very hard and firm. Such a mass is called a **solid body**. Suppose a solid body were to be heated; the distance between the molecules would increase and their mutual attraction would gradually diminish; after a time a point is reached where this mutual attraction and repulsion just balance each other and as a result, we have a form of matter in which the particles are so loosely held together that the slightest force is sufficient to break them apart. Matter in this condition is called a **liquid**. Application of heat to a liquid causes a still further increase in the distances between these molecules with a corresponding decrease in mutual attraction. At a certain point the mutual attraction is less than the repulsion, and we have then a form of matter called a **gas**, in which the particles tend to diverge indefinitely; consequently the volume of a gas is limited only by the size of the vessel in which it is contained. This property of gases is of great importance, as it has made possible the discovery of the minute entities of which, not only **molecules**, but their component **atoms** are constructed. These particles may be regarded as units of force as well as units of matter. From the latter standpoint they are called **Corpuscles**; from the former **Electrons**.

The electron is therefore the structural unit of all phenomena. It is a minute charge of **Negative Electricity**, self-centred and integral. There is no good reason for supposing that an absolute, solid, material body underlies and supports this negative charge. In a free state, electrons repel each other, and yet they are capable of forming alliances, uniting into groups consisting of from 800 to 200,000, each electron of which swings or vibrates through a definite orbit, so that a miniature solar system is formed, the electrons representing the planets, and being held in equilibrium by the attraction of a hypothetical central sun. These wonderful minute systems constitute the **atoms** of the various chemical elements, the number of electrons in a given group determining its physical and chemical properties and its atomic weight. Thus the Hydrogen atom consists of about 800 electrons and has an atomic weight of one. Uranium has over 200,000 and an atomic weight of 239. Between these extremes lie seventy odd groups of electrons which constitute the chemical elements.

In each atom the mutually repellent electrons are held in a state of harmonious orbital motion by a centralizing atmosphere of **Positive Electricity**, in which they are apparently suspended at equilibrium. In the solar system the planets are similarly held by the sphere of solar attraction. Imagine this sphere of attraction to still exist after the removal of the sun and we have a crude idea of the nature of the Positive Electricity which holds the Electrons together in the atom. A simple, yet very instructive experiment will demonstrate the universal law of harmonious association, whereby the electrons are formed into several atoms.

Several dozen fine needles are magnetized from a powerful electro-magnet, so that all the points have a like positive polarity. Each needle is thrust vertically through a small disc of cork and placed in a large, shallow basin of water. The needles are held in an upright position by their floats, and the mutual

repulsion between the magnetism of the point above the water and that of the "eyes" beneath the water causes the needles to form a circle around the inside rim of the dish. Now slowly lower over the centre of the dish the **negative** pole of a bar magnet, and when the lines of force radiating from it strike the periphery of the dish, the needles will slowly move toward a common centre, stopping when the attraction of the overshadowing magnet just balances the mutual repulsion of the polarised floats. In this way, by employing a greater or less number of needles, a variety of beautiful geometrical figures will be formed. The exact number of needles required to produce a certain figure can be determined only by experiment.

With some of these figures the **addition** of a needle will cause a dissolution of the regular arrangement, while the withdrawal of one will **weaken**, but not destroy the integrity.

Other figures respond in an exactly opposite manner.

Now, these symmetrical groups are analogous to the atoms of the chemical elements, the experiment showing that stable arrangements of the floats recur at regular mathematical intervals, just as the atomic weights of the elements indicate the existence of a **Periodic Law** governing their formation. This Periodic Law was formulated by Mendeleeff some twenty years ago, and laid the foundation of modern chemistry.

(To be Continued.)

"Hurrah for the Bounding Main!"

Wide World Photo; exclusive to the Australasian Wireless Review.

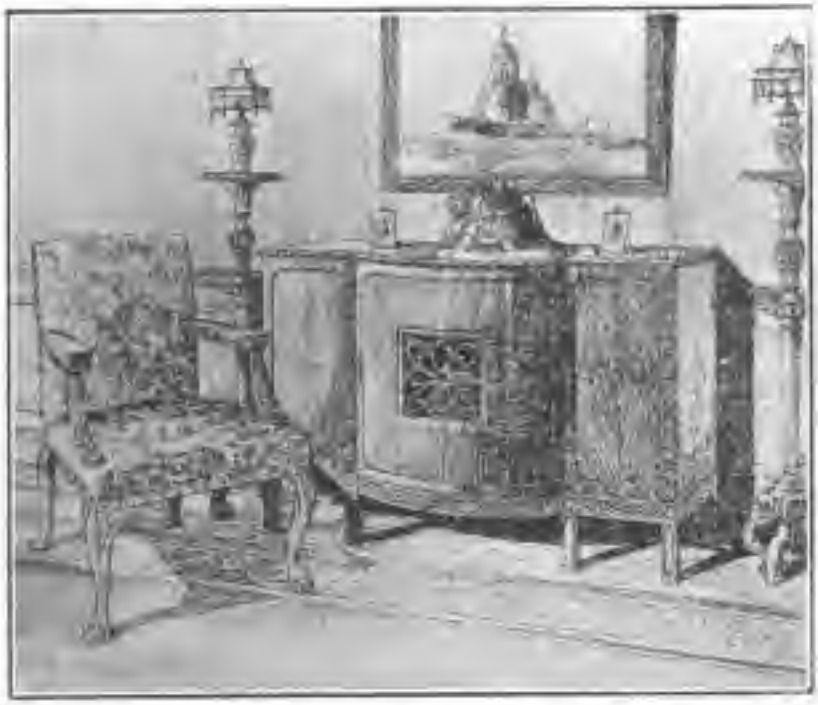
The sailoress climbing the rigging is Miss [illegible], daughter of the master of the sea-going ship "[illegible]." She is a resident of Seattle, U.S.A., and is one of the organisers of a very unique organisation, which has for its purpose the development of radio broadcasting to ships at sea. A large number of the wives, daughters and sweethearts of the mariners who ply the Pacific Ocean have inaugurated this movement, with the object of bringing the home and the ship closer in touch and sympathy. The ship owners are said to be rendering their hearty co-operation to the scheme, and when the man before the mast hears his wife or daughter talking or singing over a thousand miles of ocean, home will not seem so very far away after all.

New Apparatus and Appliances

AN EXHIBITION CABINET SET.

THE Western Electric Co. Ltd., 192 Castlereagh Street, Sydney, N.S.W., which company has agents in each large centre in Australasia, exhibited several Receiver Models of the Cabinet Type at the Exhibition recently held in London, England. Two of the models are illustrated herewith. The first one is on Chippendale lines, and is 4ft. 6in. wide and 3ft. 2in. high. It is made of specially selected, finely figured mahogany, carved and veneered, and the three doors have quartered panels, the centre one having a fretted panel for the outlet of the loud speaker.

The centre compartment contains a frame aerial which can be rotated through 180° by means of a small handle. The left-hand compartment contains the special receiver for use with the frame aerial, and on the right are the batteries and accumulators.



EXHIBITION CABINET SET NO. 2.

EXHIBITION Cabinet Set No. 2 is by the same Company and is 2ft. wide by 3ft. 9½in. high. An outside aerial is used with this type of cabinet receiver, and it is equipped with an external block for the aerial-earth connections. The exterior has a fretted frieze and three doors, the upper door being fitted with a fretted panel for the loud speaker, and the other doors have panels of curled veneer. The amplifier is in the upper part of the cabinet.

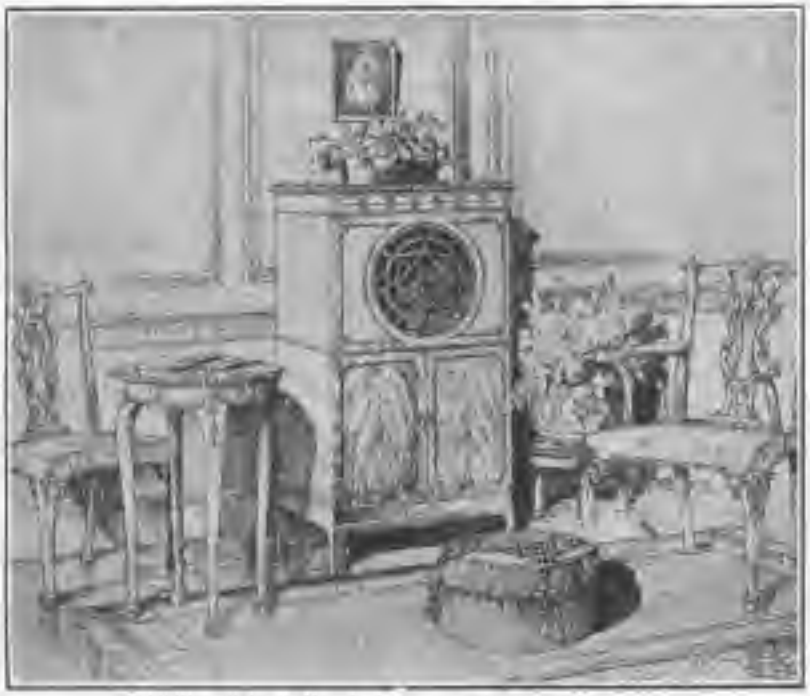
The range of both cabinets under normal conditions is 500 miles, and under most favorable conditions will greatly exceed this distance.

A DE LUXE CABINET RECEIVER.

THE De Luxe Cabinet Receiver is the product of the New Systems Telephones Co. Ltd., of 250 Castlereagh Street, Sydney, N.S.W., and 54 Market Street, Melbourne, Victoria. The Receiver has been specially designed to meet the requirements of those who desire a Wireless Receiving Apparatus of maximum efficiency with simplicity of control, and the whole is self-contained in a De Luxe Cabinet, designed to harmonise with other pieces of furniture. The instrument comprises a Valve and Crystal Set, so arranged that by the manipulation of a simple switch either can be brought into operation as may be desired, the reception being suitably amplified by two stages of audio-frequency amplification. A patented form of permanently set crystal is employed.

The second illustration shows the back view of the cabinet, the loud speaker, the "A" and "B" batteries being seen fitted into the base.

EXHIBITION CABINET SET No. 2.



Exhibition Cabinet No. 2, for use with an outside Aerial.

A COMMON-SENSE VALVE HOLDER.

IN carrying out critical experiments it is absolutely essential that the experimenter is assured that proper

contact is made with each leg of the valve. Some writers advise soldering the valve pins to the socket contacts as a means of making certain of proper contact. The Mazda Radio Manufacturing Co., Cleveland, Ohio, now turn out a valve holder as illustrated, with a socket for each pin, and a set screw to make absolute contact.

The upright piece takes the pin of the valve, ensuring that the valve is placed in the socket the right way round.

A VARIABLE GRID LEAK.

WHEN in a given circuit a grid leak of a certain resistance value is specified, the conscientious experimenter who looks for results is desirous of putting in the circuit a grid leak in conformity with the specifi-

cations. With a bit of slate or fibre he can make certain pencil marks and be guided by results on the trial and error principle. The Premier Electric Co., of Chicago, U.S.A. have now marketed a grid leak which has seven carefully calibrated values of leak resistance of ¼ megohm to twoon terminals. Guess work is therefore banished and the experimenter proceeds with a certainty that can never be the outcome of trial and error methods.

DE FOREST EQUIPMENT.

AS far back as 1912, the writer suggested to a certain Minister of Works that the De Forest wireless telephone should be installed in the lighthouses round the coast. At that time a complete sending and receiving outfit was listed by the De Forest Company, which outfit included the new Audion valves. The matter was referred to the engineers of the Postal Department, and they reported adversely. Why, it is difficult to conceive, for the apparatus was better perfect in performance, and if those engineers had taken the trouble to look into the matter properly, the lighthouse keepers might have had their loneli ho relieved through all the years which have passed since the suggestion was made.

The above will convey some idea of the length of time the De Forest people have been producing thoroughly practical and efficient sending and receiving apparatus, and needless to say every refinement and improvement has been adopted in the De Forest equipment from year to year. Knowing fully the requirements of the different types of experimenters the Company provides the full cabinet type of receiver for those who merely want to listen in, the panel, minus the cabinet, for the amateur who desires to try out the different circuits, and, finally, all the parts are supplied for those who want to build their own apparatus.

The Barnie Electric Co., of 252 Kent Street, Sydney, N.S.W., are handling all De Forest goods, and have the various types of receivers, panels, and parts ready for the inspection of the experimenter who desires to have really high-grade equipment at a reasonable cost. Mr. O. E. Mingay is in charge of the radio department, and amateurs may freely avail themselves of his mature experience in radio matters.

* * *

THE STORE ON BRICKFIELD HILL.

MESSRS. Anthony Hordern & Sons have now to hand their stocks of radio apparatus. These include Valve Receivers, Crystal Receivers, Headsets, Valves, Condensers and parts, Resistances, and all the parts necessary to make up sets. Intending purchasers would do well to inspect the radio goods available at the store on Brickfield Hill before coming to a decision.

* * *

A NOVEL VARIOMETER.

THE Rogers Receiving Radiometer is a novelty variometer only four inches in circumference and one inch in thickness over all. It is another instrument employing the spider-web coil, but in this case the winding is of the type known as the figure 8

wound inductance. Only one supporting bushing is used for the entire assembly; this bushing is also used for the electrical contact between the two inductors. The radiometer can be used in any part of the circuit in which the ordinary type of variometer may be used. The tuning efficiency and sharpness is greatly improved because the dielectric material is reduced to the absolute minimum. No wood, paraffin, shellac or varnish is used in the construction of the Rogers Radiometer. Messrs. Ludwig, Hommel and Company, of 530-534 Fernando Street, Pittsburgh, Pa., U.S.A., are the manufacturers.

CURE FOR BALDNESS.

THE Hounslow (England) Wireless Society earned international fame recently by declaring that baldness would be abolished when everybody has a radio receiving set and some headsets. The bad news for the manufacturers of loud speakers is to the effect that the electrical waves in the headsets stimulate the growth of the hair. The Society points its point by stating that all radio operators have luxuriant growths of hair, forgetting that no barber will tackle a man who wears a headset.

Receiver for Trans-Pacific Tests

By R. A. HULL and C. HIAM, Melbourne

THIS receiver was designed and built by the authors with a view to learning something of radio frequency amplification of short wave signals, and so to facilitate the construction of a suitable receiver for the forthcoming Trans-Pacific Tests.

A Trans-Pacific Test Receiver.

Thus all the gear is in units, permitting of any circuit or combination being used with ease.

Long ebonite handles on all tuning and coupling controls were found to be essential, being far more satisfactory than cumbersome shielding for the elimination of capacity effects, and permitting of extremely minute adjustment.

Many circuits have been tried, including the Armstrong Super-Heterodyne and Super-Regenerative, but to date the most satisfactory has been the tuned transformer coupled.

The tuner, on the left of the photograph, consists of 8 "spider-web" wound coils provided with a variable condenser across each, and long ebonite handles for the variation of coupling.

The first and second valves are tuned impedance capacity coupled, the third unit on the tuner serving both as the tuned impedance and as a reverse action to aid in the prevention of self oscillation.

The remaining R.F. valves are tuned transformer coupled, and are grouped in pairs, each valve being mounted with its own transformer, condenser and rheostat. The grid potential of these valves is controlled by the usual potentiometer.

All the transformers are remountable, permitting of many types being experimented with, and reversible, thus covering a greater wave range with one transformer, the primary and secondary windings having dissimilar values of inductance.

To date only 6 R.F. valves have been used, but when the owners have completely mastered the handling of same another 4 valves will be added.

The detector and two stages of audio-frequency amplification are used after the R.F. valves, the latter, of course, only when atmospheric conditions permit.

A considerable quantity of gear, not included in the photograph on account of lack of space, consists of the usual heterodyne wave meter, separate oscillator, batteries, switches, and charging equipment, the latter being particularly active since the installation of this receiver.

THE marking on most receiving sets can not be used as a direct method of determining the wavelength of received signals and is provided so as you may have some definite idea of where to look for certain stations, after you have once been able to tune them in. After a station has been heard you may make a record of the position of the dial or dials and it is quite likely that the same station may again be heard by making the same adjustment. There are some sets, which are used exclusively, which are provided with dials which do not indicate wavelengths directly, but we have become accustomed to using them and know about where to find stations operating on given wavelengths. The receivers of the vario-coupler and twin variometer type are provided with a wavelength chart which indicates the wavelength for dial settings in the secondary circuit. By this method, and using the type of aerial recommended, stations of known wavelength may be picked up by setting the proper dial and then adjusting the others. The wavelength of any station within range of the set may be measured by first properly tuning the receiver and then reading the wave-length from the chart for the particular setting of the secondary tuning dial. In instances of this sort the wavelengths are not very accurate but serve quite well for all practical purposes, and where accurate measurements are required a wavemeter should be employed.

Wave-Length Charts Supplied with Receivers

Radio Club Activities

THE Leichhardt and District Radio Society continues to make steady progress, and new members are constantly joining up. The society has decided to participate in the coming Trans-Pacific Tests, and with anything like a fair chance, it should figure amongst those who are successful in getting the American amateurs' signals through.

The usual meetings have been held during the past month, and have proved both attractive and instructive.

Mr. W. J. Zech, the hon. secretary, delivered lectures on "Inductance" and "The Condenser and its Uses." Mr. F. Thompson contributed a lecture on the subject of "Alternating Current."

Code practice with key and buzzer, and discussions on radio matters generally, which are a feature of practically every meeting of the society, are specially helpful to those new members who are beginners in the wireless art.

The weekly meetings are held every Tuesday evening at the Club Room, Victory Hall, rear of Methodist Church, Johnston Street, Annandale. Mr. W. J. Zech, the hon. secretary, of 145 Booth Street, Annandale, will be pleased to hear of anyone interested in the society.

* * *

THE Newcastle and District Radio Club is enrolling new members every day, and it promises to be one of the biggest clubs outside the city and suburbs. The experimenters of the district are taking advantage of the opportunity afforded by the club meetings to gain practical knowledge of matters pertaining to radio science, in furtherance of which the officers of the club have outlined a programme designed to convey the maximum of instruction and information.

* * *

THE North Sydney Radio Club meets at 8 p.m. Tuesdays at the Club Rooms, corner Alfred and High Streets. Our mutual friend, Mr. Raymond McIntosh, recently gave an interesting lecture on "Amplification," which proved to be highly instructive.

THE Manly and District Radio Club is another new club and has been successfully launched through the efforts of Mr. F. C. Swinburne, a well-known and capable radio experimenter, who was elected president. The vice-president is Mr. Howe; hon. secretary, Mr. O. Sandel; treasurer, Mr. Clarke; committee, Messrs. H. Dixon, Crocker and Symes. General meetings are to be held on Monday evenings, and Wednesday evenings have been set aside for buzzer classes.

This club is introducing a rather novel feature. Two portable sets are to be constructed, and field parties will be divided into two sections, so that transmitting and receiving may be carried on by the different sections, each some considerable distance from the other.

Amongst the latest visitors to the Manly Radio Club were Mr. A. E. Atkinson, Secretary of the Radio League of Australia, and Mr. Marsden. Mr. Atkinson addressed members regarding the aims and objects of the Radio League, and Mr. Marsden gave a lecture on Club formation and the routine of carrying on a Club.

During the same evening Mr. Swinburne, President of the Club, gave a very interesting lecture, illustrated by lantern slides, which showed photographs of wireless apparatus, and a number of English, American and Continental high-power stations.

* * *

THE Metropolitan Radio Club has again elected Mr. C. Marsden as president, with Mr. A. Atkinson vice-president, Miss F. V. Wallace treasurer, Mr. C. McKenzie hon. secretary, and Messrs. Cotterill, P. Sewell, McIntyre and S. Atkinson committee.

The meeting night has been changed from Wednesday to Monday, to avoid clashing with the meeting nights of the Suburban Radio Clubs.

Meetings are held at the Laurel Cafe, Royal Arcade, Pitt Street, Sydney, and communications should be addressed to the Hon. Secretary, c/o Miss Wallace, Royal Arcade, Sydney.

At the Club's last meeting, Mr. Stowe gave a lecture on Wave Meters, their Use and Construction. The members were highly delighted with the very fine address given by Mr. Stowe, and voted it one of the best instructional lectures the Club had had the pleasure of listening to.

THE Marrickville and District Radio Club meets each Monday evening at 8 o'clock at the Congregational School Hall, Perry Street, Marrickville, when lectures, discussions on the practical aspect of radio, buzzer practice and demonstrations of manipulating apparatus entertain and instruct the ever-growing circle of members.

* * *

THE Drummoyne Radio Club has come into being and has elected as its officers: President, Captain F. Robson; vice-presidents, Dr. Menzie and Messrs. Mellor, Moore and Bruce, hon. secretary and treasurer, Mr. J. Manning; technical committee, Messrs. Colvillo, Guthrie, Woolnough, Vincent, Wright and Cox.

Communications may be addressed to Mr. A. G. Lucas, "Columbo," Taylock Street, Drummoyne.

* * *

THE Western Suburbs Wireless Association has recently carried out some good reception work, music and speech being heard quite clearly from a Victorian amateur. Working with a circuit which included a V24 valve, without "B" battery, using the 6 volts of the "A" battery, loud signals have been received from all the coast stations, and with the addition of one stage of radio-frequency, and still using the 6 volts, by way of "B" battery, New Zealand has been brought in. It is stated that when using only 6 volts for the "B" battery practically all static was eliminated.

Inquiries addressed to the Hon. Secretary, 4 Child's Street, Lidcombe, will receive prompt attention.

* * *

A CLUB has been formed to embrace the districts of Edgecliffe, Vaucluse, Watson's Bay, Rondi and Double Bay, and the following officers have been elected:—Mr. R. C. Marsden, Vice-President; Mr. Wallace Best, Hon. Secretary; Mr. Peters, Treasurer. A committee is to be elected. About forty members enrolled at the first meeting and a number of others are about to join.

Mr. Wallace Best's address is Carlisle Street, Rose Bay, (Call 2.E.R.), the telephone number is F7464, and he will be pleased to give any information desired to anyone interested in the Wentworth Radio Club.

THE Wollongong and District Radio Club.—This is the title of a new club which has been formed by the radio enthusiasts of the Wollongong district. Twenty members joined the club at the initial meeting, and it is anticipated that a large number of experimenters will be enrolled within a month or so.

Arrangements are in hand for monthly lectures, and for providing practical information for members.

* * *

ILLAWARRA Radio Club reports that new members are steadily coming along, and a cordial invitation is extended to all the experimenters in the district to attend the club's meetings. The club room is at 75 Montgomery Street, Kogarah, and meetings are held on Thursday evenings at 8 o'clock. One of the best lectures the members have had the pleasure of listening to was one by Mr. Watkin Brown on "Crystals." The lecturer pointed out that many minerals were still untested, and many of them might prove valuable in connection with radio science.

* * *

THE Waverley Amateur Radio Club meets on Tuesday evenings for buzzer practice and technical discussion. A new tuner has been added to the club's set, and Mr. Bowman and Mr. Thompson were accorded a hearty vote of thanks by the club for their work in connection therewith. Mr. Prendergast has presented the club with another key and buzzer, a practical way of helping matters along.

Mr. G. Thomson is the hon. secretary, of 87 Macpherson Street, Waverley.

* * *

THE Campsie and District Radio Club meets every Wednesday at 7.45 at the Starr-Bowkett Hall, North Parade, Campsie. The hon. secretary is Mr. W. Hughes, "Loch Vennachar," Evaline Street, Campsie, and amateurs in the district are invited to communicate with him, or to attend any of the weekly meetings.

From time to time interesting lectures are given on the construction of radio apparatus, a lecture recently given by Mr. Hobbs on "Loose couplers" being very much appreciated.

Melbourne Notes

A "REVIEW" representative has just returned from Melbourne, and reports that the amateurs are getting busy there and have arranged a schedule for transmitting music, etc., every night. Each amateur transmitter is to take one evening to give his fellow experimenters radio telephony to test their receivers on. As soon as the schedule is compiled, we are to receive a copy and it will be published in the next issue of the "Review." This will give the time the telephony starts and finishes, the wave lengths employed, and the name and call number of the transmitter. It is stated that Melbourne amateurs regularly hear Mr. Maclurcan's Sunday night concerts, and when the regular transmission starts in Melbourne, amateurs in other centres should report results of listening in, on the Melbourne transmission. Melbourne amateurs hope that Sydney and other centres will arrange similar schedules, amongst the amateur transmitters, either individually or as Clubs, so as to give them the opportunity of trying long distance telephony.

We beg to offer Melbourne our hearty congratulations on having the enterprise and initiative to provide their own concert programmes, instead of waiting around for some one to make a start. Sydney will surely follow suit, and by mutual arrangements between the individual amateurs and Clubs with transmitting apparatus, it should not be difficult to arrange that each take one night a week to send music and voice for a couple of hours.

Our representative says he found that until a fortnight ago the only telephony available in Melbourne was a short run of thirty minutes on Monday evenings, with the exception of transmission experiments conducted by Mr. J. P. Court, who has obtained some very good results. Mr. H. W. Maddick, 3 E.F., Elwood, Melbourne, has constructed a very fine receiving set, which he courteously placed at the disposal of our representative to listen in to the Melbourne amateurs. He heard 3 J.U., Mr. R. A. Hull, St. Kilda, call up, and he was answered by 3.B.D., Mr. E. H. Cox, Elsternwick, and 3.B.Y., Mr. H. Holst, Caulfield, answer saying they were ready to assist in the experiments. Then at 3.J.U. Mr. O. H. Knarkoi rendered a violin solo, with piano accompaniment, and the modulation was perfect, the volume all that could be desired.

Mr. Hull then called for comments, which were freely given by 3.B.D. and 3.B.Y., with helpful criticism and due praise.

More violin solos and piano selections followed, with a pianoforte item from 3.J.U. and gramophone records from 3.B.Y.

Melbourne amateurs will be well off for radio telephony when the schedule starts to operate, which it is likely to do before this article comes under the notice of our readers. All the amateurs mentioned were transmitting on a 440 metre wave length.

Amateurs in other centres will perhaps be good enough to report to this office the result of listening in on the Melbourne amateurs.

MR. J. A. NEWTON, of 370 Bourke Street, Melbourne, one of the oldest established electrical supply houses in that city, will have full stocks of all radio supplies at an early date. Mr. Newton, jun., in charge of the radio department, will have pleasure in advising experimenters in connection with any enquiries re radio they may desire to make. The "Review" is on sale at Mr. Newton's establishment.

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MESSRS. NORRIS & SKELLY, 346 P.O. Place, Melbourne, have large consignments of radio apparatus coming to hand to augment their present stocks. Mr. Mann is in charge of the department, and enquirers may rely on having a courteous reception. The "Review" may be obtained there.

* * *

MR. OLIVER J. NILSEN, 386 Flinders Street, Melbourne, has an extensive range of radio goods, including high tension generators and complete transmitting sets, the latter manufactured by the Federal Company. He is the Commonwealth agent for Federal Wireless equipment. Mr. Boyd is in charge of the department, and his expert knowledge is at the service of amateurs. Ask for "The Australasian Wireless Review."

* * *

HOMECRAFTS, 211 Swanson Street, Melbourne, is an old established supply house for all kinds of scientific apparatus, electrical and mechanical models and toys, including model aeroplanes, steam models, etc. Mr. McElroy, the proprietor, convened the first meeting of radio experimenters in Melbourne, and this meeting was the beginning of a series of activities which resulted in the formation of the Victorian branch of the Wireless Institute of Australia.

"Homecrafts" has become a well-known brand on many kinds of radio apparatus, and it is now recognised as the hall-mark of high-class radio goods.

THE Kellogg people are making up the filter unit for the Armstrong Super-Regenerative circuit, and by the time this notice appears the unit, made up of the two 12,000 ohm non-inductive resistances and the 1 Henry Iron Core Choke, will be available at The James Chambers Proprietary Ltd., 374 Little Collins Street, Melbourne, as stocks of Kellogg Radio Apparatus were just about due to land when our representative was in Melbourne. Further particulars of the Kellogg equipment are to be forwarded to us as soon as they are available.

* * *

MR. S. H. HULL and Mr. C. Hiam have designed a very practical looking set for the reception of the Trans-Pacific Tests, and they were good enough to hand our representative an excellent photo of the set, together with a detailed description of it, which appear in this issue.

* * *

SOME interesting matter re the Trans-Pacific Tests has been courteously furnished by Mr. H. Kingsley Love, past President of the Victorian Division of the Wireless Institute of Australia. A circular published at Long Beach, California, U.S.A., reads, in part, as follows:—

PLANS PERFECTING.

"Long Beach will owe her fame as the city on this side the Pacific to take part in this contest to two conditions—one is her location, as nearer to Melbourne than any other large city in America; the other is her prompt grasping of the opportunity presented by a prominent local radio scientist of Australia, who last April opened negotiations by writing a number of radio clubs on this coast.

"The Australian proponent is Mr. H. Kingsley Love, who has taken the matter up with the Victorian section of the Wireless Institute of Australia and secured official endorsement of his plan to collaborate with Long Beach in the experiments planned."

The foregoing quotation will serve to show the importance attached to the Trans-Pacific Tests by the American amateurs, and it is to be hoped that they will be met in a kindred spirit by the amateurs of Australasia.

A NEW THREE-COIL TUNING INDUCTANCE.

HERE is a three-coil tuner, primary, secondary and tickler, of the spider-web type. Some prominence has been given in the "Review" in the last two issues to this type of coil, and experimenters will find that it is bound to become a universal favorite in the near future. One Eng-

lish radio manufacturing concern advertises a set of seven of these coils to cover a range of wave-lengths from 150 to 4500 metres, at 5/3 THE set. To those who are not too well blessed with this world's goods the spider-web coil comes as a "boon and a blessing to man." Not only is it cheap, but it is highly efficient also.

ELECTRICAL SECTION

Electricity in the Home

In the March Review the advantages of applying electricity to laundrying were set out and it is certain that there will be an increased demand for electrical washing machines, when it is realised that in one machine, washing, wringing and boiling can be carried on. The application of electricity to the family sewing was briefly dealt with

The Electric Motor applied to the ordinary treadle Sewing Machine.

and it was pointed out that an electrical sewing machine costs no more than the old-fashioned type. With an electrical sewing machine, a great quantity of sewing can be done without the least fatigue, and this cannot be said of the ordinary sewing machine, which demands a big expenditure of energy in the course of a day's sewing. This fact has been recognised by clothing factory owners, who have found that more work is turned out, per operator, and that the average time taken off on account sickness is infinitely less. Leading physicians will tell one that working the treadle of a sewing machine all day is absolutely inimical to women's health, and that quite a lot of surgical operations are rendered necessary for young women who are constantly subjected to the heavy drudgery of the foot driven sewing machine.

Our illustrations include another view of the electric motor as applied to an ordinary treadle machine. Without any screwing or "fixing" in any way, beyond just placing the little motor on the table of the machine, sufficiently near to the handwheel to allow the small motor pulley to touch the rim of the handwheel, and plugging the cords of the motor into the most convenient light socket, no labour is required. The ideal arrangement is to buy a light running hand machine, which can be carried from room to room if required, and to attach the sewing machine motor to it.

We now come to consider the convenience of an electrically equipped kitchen.

THE ELECTRIC DISHWASHER

It washes the dishes, glass and silverware, all at one time; it dries them, heating the dishes, etc., with the boiling water used for rinsing them, and it drives off the moisture. Breakages are reduced to a minimum as there are only two handlings—one in putting them in the machine and the other when they are taken out. There is no bother in keeping the machine clean as the boiling water, used in the rinsing, cleanses the machine, leaving it ready for the next washing-up. Smooth running casters allow the machine to be run right up to the table so that the dishes may be placed direct in the washing racks with the unnecessary labour of carrying them to the kitchen entirely done away with. An electric motor attends to all the washing, and it is done most thoroughly and completely. The motor connection plugs into any lamp socket. The greatest bugbear of the lady of the house is the always recurrent

A Typical Electric Dishwasher.

washing-up process. Electricity will do this monotonous part of the domestic routine quicker, cheaper, and better, than it can be done by hand.

A photo is included herein of a typical electric dish-washer. This electric dish-washer is in stock at Messrs. W. G. Watson & Co.'s Electrical Supplies Depot, 279 Clarence Street, Sydney.

Our Monthly Photographic Competition

Very many Wireless Experimenters are also photographic enthusiasts; others have amateur photographer friends who will co-operate with them in sending in exhibits for the monthly competitions of

"The Australasian Wireless Review"

Every month we offer a prize of ONE GUINEA for the best photo of an amateur wireless set in any part of Australasia. TEN SHILLINGS AND SIXPENCE will be paid for the SECOND BEST, and FIVE SHILLINGS for the THIRD. A SPECIAL PRIZE OF TEN SHILLINGS AND SIXPENCE will be awarded for the best radio novelty photograph.
The prizes to be awarded for the best Wireless Sets may be won by those possessing any kind of Set, Crystal or Valve; efficiency, neatness of workmanship and quality of photograph, being the leading factors to be taken into account.

The PRIZE of 10/6 for the NOVELTY PHOTOGRAPH will be awarded for the best photograph of any novel picture or scene in which a radio receiving apparatus is used. Pretty garden party scenes, children listening in, animals hearing radio concerts, &c., suggest themselves as amongst the suitable subjects.
A full description of the competing set to be forwarded, together with wiring diagram of same if possible.

Full names of people, and full description of the photo appearing in novelty photos section is desirable.

All photographs to be the property of the Proprietors of The Australasian Wireless Review. The Editor's decision to be final.

Photos may be sent in at any time, and all the photos to hand by the first of each month will be included in the following month's REVIEW COMPETITION.

Here is the opportunity to win a guinea, half a guinea, five shillings, or the special prize of half a guinea, and at the same time to let your fellow experimenters know what you are doing in your section of Australasia.

Send your photo in To-day! *Do not Delay!*

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